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NOTES ON ENTOMOLOGY IN THE FEDERATED MALAY STATES DURING 1917.

By P. B. Richards.

A COUNTRY which is in course of opening up for cultivation must of necessity see the upsetting of its "balance of nature," the delicate adjustment which results from undisturbed ages of competition between plant and plant, animal and animal under natural and constant conditions. Alien plants replace wide areas of jungle trees and undergrowth. In place of a mixed association of plants of varied nature and discontinuous distribution there arises a continuous cultivation of one species, or at best the cultivation of a few species, each over a wide area, of more or less permanent crops. The wild food plants of countless insects, birds and beasts, disappear almost at a stroke, never to return so long as industry can profitably employ the ground. Much of the native fauna is thus starved out of the altered blocks; not alone the vegetable feeders, but also the hosts of predators and parasites which depend upon them, and which serve to keep even the most prolific from becoming unduly abundant. Only those species remain which are able to adapt themselves to the changed conditions, sooner or later finding in the cultivated plants a suitable food, and to which the different environment is no bar. Their natural enemies may, or may not, be able to stay with them. It is from such species that pests arise. Given partial or absolute release from natural controlling factors, and a plentiful food-supply with little competition, they have an excellent opportunity to increase to abnormal numbers, and to assume pest proportions over areas bounded only by the limits of the crop.

Adaptation to the new conditions may be almost immediate, or may come about by natural selection operating over a considerable period of time. Crops which promise well, and remain fairly free from pest and disease for years, may thus ultimately become attacked. Every crop must be regarded as a potential host and almost every vegetable-feeding insect as a potential pest of present or future crops. No crop, however well established, can be considered permanently safe—and this applies equally to fungus and other diseases as to insects. By immigration, casual importation, adaptation,—perhaps one should say mutation,—even the hardiest crop may become the object of serious attack. To prevent pest attacks arising

is beyond human powers; but to detect and diagnose them, to devise treatment that will circumvent them, limit their destructiveness, and reduce to a minimum the resulting economic loss, are among the more important functions of economic entomology.

There is no important crop in the world, within the writer's knowledge, which is attacked by so few serious pests as is *Hevea brasiliensis* in this country. That our major crop has such a limited pest-fauna is all to the good; but this, together with the seriousness of the fungus and other diseases which are the *bête noire* of the rubber community and have constituted the main portion of the field of local mycological research, has perhaps tended of late years to obscure the potential importance of insect investigation and control work. Those who can remember the havoc wrought by the coffee clearwing, or even the white ant scare before fears were allayed by the false security of the "Universal Exterminator," will not fail to appreciate that importance; but in general the preventive and remedial treatment of pests other than white ants in rubber, and red weevil and rhinoceros beetle in coconuts, receive little consideration by any but a few coconut and coffee planters, and some enthusiastic horticulturists. While rubber is the only crop concerned this attitude may persist, possibly without serious results. But a similar attitude adopted by the coconut planter might easily result in disaster. At the moment insects are of more importance to his estate than are fungi, both as friends and foes, and with increased knowledge there is every reason to expect that the importance of insect control on coconuts will be enormously enhanced. There is here an extensive and little-trodden field for research. Every part of the plant,—root, stem, leaf and spike,—may be affected by insects, and it is of the utmost importance to the industry that the relation between insects and the welfare of the palm be determined, and be understood by the plantation staff.

Among the minor crops, coffee, castor, indigo, sugar, cinchona, camphor, are all subject to serious injury if steps are not taken to control their pests. Every planter whose experience embraces tea or cacao cultivation knows the importance of routine pest-control, and appreciates the fact that money spent in treating pests earns a good profit. New crops, especially food-stuffs, are now being introduced to Malaya. All are practically certain to provide suitable hosts for our native insects, even if no foreign pest be introduced with the seed. The damage may be negligible, or it may be serious. In few, if any, cases should pests preclude the successful cultivation of any crop otherwise suited to the country if reasonable care and precautions are taken. But the need cannot be too strongly emphasized, to be prepared to provide labour and materials as freely for pest-treatment as for cultivation, weeding, or any other requisite of successful agriculture. A niggardly attitude towards pest-control may well be penny-wise, pound-foolish.

Insect Collections.

A general collection, comprising as complete a reference as possible to all the insects in the country, is of prime importance to applied entomological work. This is in the hands of the Systematic Entomologist, Mr. Holman-Hunt, assisted by a native collector. During the year two collecting trips were made into Pahang and

Negri Sembilan, on which the Systematic Entomologist obtained large collections of insects many of which are new to Science, and many others not previously recorded in Malaya. Identification of the new collections, and re-arranging and listing the new and old collections, occupied the rest of the year.

In addition to the general collection, a pest collection is gradually being built up.

Insect Investigations and Routine.

Owing to the continued shortage of staff, office routine, visits and lectures, life history and breeding and field investigations had to be attended to mainly by the Acting Government Entomologist. At the close of the year the transfer of an Insectary Assistant from India was arranged. This officer now carries out much of the life-history work under the direction of the writer.

During the year, one hundred and eleven species of insects and two species of mites were under life-history observation in the laboratory, most of the species being of economic importance.

Field investigations included a detailed study of the life history of the rubber leaf mite, and experiments in control measures.

Two outbreaks of *Brachartona catoxantha* on coconut estates were kept under observation for the life history of the pest and its parasites and for experiments in control.

Experiments in clean clearing in fields of young coconut palms were started to provide reliable data for testing the soundness of this method with reference to the control of white ants and rhinoceros beetles.

Further observations upon the biology of *Coptotermes* (*Termes*) *gestroi* were made on rubber and coconut estates as opportunity offered but no extended period could be devoted to a fuller study of this interesting and important insect.

Among other major and minor pests which came up for brief or preliminary investigation were two new pests of coconuts: a moth caterpillar and a mite, both of which injure the flowering spike; various Limacodid caterpillars (Nettle grubs), Psychids (Bag-worms), and many species of Coccidæ and Aleurodidæ (Scale-insects, etc.), on leaves of coconut and rubber; swarming caterpillars on young rubber plants; and a powerful burrowing Crustacean, *Thalassina anomala*, through the burrows of which serious loss of irrigation water results in Krian.

Rubber Pests.

No serious new pest of *Hevea brasiliensis* arose during 1917.

(i) *Coptotermes* (*Termes*) *gestroi*.—This is still the most important pest of rubber. The increasing recognition that clean clearing is the only means for eradicating "white ants," and the enormous impetus given to clean clearing by recent mycological research has, however, resulted in the destruction of nearly all suitable nest-logs over considerable areas. The condition of affairs is still far from satisfactory, as many areas still remain uncleared.

Moreover, on old fields in which the timber has gradually disappeared by rotting, some nests remain established, often unsuspected, in the standing rubber trees.

In virgin jungle the colonies of this insect are far from numerous. The intensity of the infection of *Coptotermes gestroi* all over the country is undoubtedly due to the spread of the pest to successive fellings, from older fellings the undestroyed logs and stumps in which have afforded numerous nesting sites for vigorous colonies. Clean clearing, thus, as far as "white ants" are concerned is perhaps more important in its future than in its immediate results. In addition to the immediate reduction of attack after destroying the nest-logs, there will of necessity be a marked diminution in the intensity of infection in future clearings. With universal clearing up of dead wood, and systematic treatment of attacked trees, the writer anticipates that there will remain so few distribution centres, that *Coptotermes gestroi* will cease to be a serious trouble to average rubber and coconut estates.

Specimens of the king of this species were obtained in nests with true, and also with substitution, queens. The king is active, and shuns light, so that on opening a nest log he hides in the smaller galleries. This may be the reason why these are the first authentic specimens to be obtained.

Coptotermes gestroi has long been suspected of bringing wood-rotting fungi such as *Poria* and *Ustulina* into attacked trees. There is now considerable evidence that it is frequently responsible for "brown bast" attacks also. In course of examining numerous "white ant" trees the writer often observed recent "brown bast" infections at heights up to five feet from the ground in the bark attacked by white ants under cover of their earth casing. Inspection of many "white ant" trees which showed "brown bast" at the collar pointed to the probability that in most such cases also the insects were indirectly responsible for infection through wounds below the soil level.

(ii) *Rubber leaf mite.*—Small local attacks of this pest have been noted for three years, mainly in nurseries, and have been treated with considerable success. The discovery of an attack over several hundred acres of an estate which has been consistently treated for leaf fungi afforded an opportunity for studying the biology and economic status of the pest, and for experimenting with control measures on a field scale.

The rubber leaf mite is a pest which, under certain conditions of soil and weather, is capable of doing considerable injury to young rubber fields. The mite is very minute, the adult female being less than one-hundredth of an inch in length, while the eggs and young stages are practically invisible to the naked eye. Feeding is accomplished by puncturing the epidermis of the young leaves and shoots and sucking out the fluid cell-contents. Each individual is responsible for numerous punctures per day. The life-cycle is short, occupying only five to seven days, and the females are prolific, laying fifty or more eggs; thus, when conditions are favourable for development, enormous numbers of mites are present on the attacked

plants. The effect upon the host plant varies from distortion of the leaves to repeated defoliation of the young shoots and ultimate death of the plant, according to the virulence of the attack, the vigour of the host plant, soil and weather conditions, and various other factors. Serious mite attacks are frequently followed or accompanied by leaf and stem fungus attacks, notably *Helminthosporium heveæ*, *Gleosporium*, *Phyllostycte*, and later, *Diplodia*.

The minute size of the mite has resulted in its being frequently overlooked, and the damage done directly or indirectly by it has been ascribed solely to the fungi mentioned.

The rubber leaf mite is present, probably, on every estate throughout the Peninsula, but it has so far assumed pest proportions only where root conditions have not been ideal for the growth of *Hevea brasiliensis*. In such places the attacks have caused checking, stunting, and death of seedlings in nurseries; sickly, stunted, and mis-shapen growth necessitating repeated supplying in young clearings; and in one case the loss through exhaustion and die-back of several hundred five-year old trees. There is no doubt that the mite is of serious importance on estates where the soil conditions do not favour the growth of rubber, as the pest may prove the determining factor between a fairly good and a bad field. Improvement of soil conditions by draining, manuring, or cultivation is the first essential of preventive and remedial treatment. But where the attack has a good hold on an area, spraying is necessary. It is found that lime-sulphur wash containing two pounds of sulphur per 100 gallons is a most satisfactory spray, acting strongly on the mites, and with considerable effect upon the leaf and shoot fungi. The spraying requires to be done twice with a ten-day interval, and thereafter once in three to four weeks upon such nurseries and young stock as show re-attack. If the pest is watched for and treated as it appears while the plants are less than a year old, its attack is unlikely to assume serious proportions on normal estates.

There are indications that a small percentage of rubber trees are resistant to mite attack. The establishment of a race of such mite-resistant trees for areas known or likely to be mite infested would probably be the most effective measure of all for fighting this pest.

(iii) *Swarming caterpillars.*—A swarm of caterpillars attacked a field of young rubber at Kuala Selangor during the second quarter. Moths bred up from them proved to be *Spodoptera sp.* The district had previously been subjected to flooding, following which a considerable generation of swarming caterpillars was able to mature on rank grass. An enormous number of moths resulted which laid their eggs in a young clearing planted with stumps and seed at stake. The caterpillars which emerged ate first all the available grass and weeds which constitute their normal food, after which, probably driven thereto by hunger, they attacked the young rubber plants, and in a few days all the foliage and young green bark was stripped over several acres. Hand picking considerably reduced the numbers of the caterpillars, but the attack was sudden and short. When the outbreak was reported the caterpillars were mostly full-fed and ready to pupate so that it was useless to attempt to treat them with a stomach poison.

Large numbers of swarming caterpillars or army worms in grass or blukar near young rubber should be regarded with grave suspicion, and preparation made on the estate concerned to deal with them should their wild food supply run short. A similar outbreak has been observed alongside mature rubber, in which the caterpillars proved more of a nuisance than a pest as they drank latex in the tapping cuts and got inextricably mixed up with the scrap.

(iv) *Bark-eating caterpillars.*—Reports of damage by, and specimens of, a curious bark-eating caterpillar have been received from various localities. The caterpillars obtained would not feed in captivity, so the species has not yet been identified. The largest individuals so far seen were just over an inch in length and a tenth of an inch in breadth, the body segments cylindrical, brownish-red in colour, and each segment provided with a pair of long thick clubbed hairs which stand out from the body and curve downwards giving the caterpillar when at rest much the appearance of a small centipede. This insect damages rubber trees by eating the bark, either tapped or untapped, and causing small irregular wounds. It is at present not sufficiently numerous to warrant any other treatment than hand picking.

(v) *Seedlings attacked by small rodents.*—Small rodents were responsible for the destruction of a considerable acreage of young rubber within a few weeks of planting up with basket seedlings.

The attacks were always in areas affording plenty of cover, such as roots, stumps and unburnt timber, the animals appearing to avoid going far in the open.

The trouble can be reduced by planting strong stumps, or by clearing up the area affected.

(vi) *Minor pests affecting rubber leaves.*—The leaves and young shoots of *Hevea brasiliensis* remain remarkably free from extensive insect attack. Various species of Bag-worms (Psychidæ) have been noted on leaves during the year, but in small numbers only. Four species of Coccidæ (Scale-insects) have been observed doing considerable damage to weak and sickly plants, but their attacks have so far been extremely local, limited in most cases to a few individual trees.

Pests of Coconuts.

(i) *Coptotermes gestroi.*—This white ant continues to be a serious pest of palms all over the country wherever timber has been allowed to remain more than three years in the plantations. Very considerable progress has, however, been made in destroying timber and stumps on many big estates, with highly satisfactory results upon the incidence of Termite attack.

It is a frequent occurrence that after removing the timber which constitutes the nesting sites and a considerable part of the feeding ground of *C. gestroi*, there appears to be a violent increase in attack, both on coconut and rubber plantations. This should not be a cause for alarm. Wherever a nest log is destroyed there is bound to be a considerable proportion of the inhabitants away foraging, and it is these which, cut off from their home, hurriedly construct earth casings around the trunks for immediate shelter and food. A cooly, with half a coconut husk to use as a scrubber, can easily deal with these stragglers.

(ii) *Coptotermes travians.*—Although this smaller "pal pootchi" must remain under suspicion, and should be eradicated along with its bigger relation, palms upon which this insect is always busy, having been kept under observation for twelve months, show no attempt at penetration of the trunk, the dead tissue about the leaf bases alone having been utilized by them.

(iii) *Oryctes rhinoceros.*—The destruction of timber and Nibong stumps has an important effect upon the numbers of rhinoceros beetle within and around the cleaned area. Grubs and pupæ, frequently to the number of several hundred per acre, are destroyed in course of the work, and the available breeding ground for future generations is materially reduced. The effect is very marked, and rather surprisingly local, in areas which have been clean cleared.

Digging for the grubs in all likely feeding grounds has proved remarkably successful also. The manager of one well-known estate claims that by this means he has practically stopped the attack, which previously was fairly heavy. Digging appears to give best results during wet weather, when the grubs are driven up near the surface.

Great assistance to the coconut planter is rendered by a species of Scoliid wasps, the larvæ of which are parasitic upon the grubs of *Oryctes*. At times considerable numbers of the females of these handsome, black and yellow digger-wasps can be seen skimming close to the ground, in search of the whereabouts of the fat, well-grown beetle grubs which are feeding, may be several inches, under ground. The grub located, the wasp settles and digs its way through the soil to its quarry. The mother wasp then proceeds to render it fit for the deposition of its eggs, and the subsequent nourishing of its offsprings. The grub must not be killed because the food must remain fresh and untainted until the parasite is full-fed. But the prey must be reduced to absolute immobility lest the fragile egg to be deposited on its skin, or the scarcely less fragile larva which issues therefrom be damaged during the movements of the grub through the soil. How to ensure the necessary conditions for supplying to its offspring a continuous, fresh and unresisting source of food is the problem which confronts every mother Scoliid when her eggs are ripe for laying. The method adopted is similar to that so admirably described by the most delightful of all interpreters of insect life, the French Entomologist, Fabre. The long sharp sting of the powerful insect, which is never used for offensive purposes as are the stings of bees or hornets, is inserted with marvellous precision into the ganglia which control the motor nerves of the grub. A small number of minute pricks, and the victim is rendered powerless to move, and probably numbed into painlessness. But it is still alive and will remain alive for some time, sufficient for the egg laying, hatching, and nourishing of the larva which will find in it a supply of fresh food to last through its period of development. Our *Oryctes* hunting Scolia,* having paralysed its victim into quiescence, proceeds to lay a single egg on the side of the beetle-grub, in one of the creases in the skin which mark the segments of the abdomen, and then abandons its offspring to hunt other grubs for further layings. No chamber

* *Scolia procer.* Illiger.

is prepared or exit tunnel constructed. A sufficient store of food is ready, the egg is laid, and the parent's duty is finished. Henceforth the larva must fend for itself.

When it emerges from the egg the larva is a small, slender, white, worm-like creature. It immediately proceeds to penetrate the skin of its host, thrusts its head through the small hole, and begins to feed on the semi-fluid contents of the grub's body. The abdomen of the parasite remains outside the body of the host. There are no legs or suckers for attachment, only the small head is inserted through the skin. One convulsive movement of the grub would be sufficient to dislodge the parasite. But the Scolia has done her work well, and her offspring feeds undisturbed. Gradually the beetle grub loses its bulkiness, becoming more and more a shrunken relic of itself, while its parasite, first exhausting the stores of fluid food laid up in the corpulent body, later thrusts its head deeper in, making its final meal on the vital organs of the victim, and then withdraws, full-fed, from the empty skin which is all that remains of the beetle grub. The corresponding change in the parasite is equally remarkable. From a minute, not unpleasing grub, it grows rapidly into a flaccid, loathsome object about $2\frac{1}{2}$ inches long and the thickness of a lead pencil, its smooth, shiny skin distended with the food stored up against its pupation. A cocoon of russet brown silk is spun, felted on the outside, smooth, cemented and polished within, the larva pupates, undergoes its metamorphosis, and the adult Scolia emerges, pushing off the cap-like end of the cocoon, and digs its way up into the sunlight.

The cocoons which are bluntly oval, and roughly an inch and a quarter long by three-quarters thick, are frequently turned up in course of cultivation or grub-hunting. Coolies should be instructed not to destroy them. Scolia procer does not appear to be capable of effecting more than a moderate degree of control over *Oryctes*. Its effective limit leaves plenty of grubs to develop a serious attack on the palms. When, however, considerable numbers of beetle grubs are destroyed artificially, there is much more chance for a high percentage parasitisation in those remaining in the soil.

(iv) *Plesispa reichii. Chapuis.*—This beetle, which has been for some time wrongly called *Bronthispa* in Malaya,* appears to be increasing in seriousness.

It was noted in 1914 and 1915 as a minor pest. In 1916 its range of destruction was found to include the whole of Perak and Selangor, and serious damage was inflicted on scattered areas. During 1917 it was necessary on one coconut estate to treat the pest on a large field of young palms, while observations on young and old palms in estate and native cultivations all over the country indicate that it is considerably on the increase in numbers and consequently in virulence.

Owing to the habits of the insects, the majority of which spend their larval and adult life between the unopened pinnae of the young fronds, it has not yet been found possible to treat the pest successfully by poison sprays, as the poison cannot easily be forced between the closely adpressed pinnae upon the tissues of which the insects feed.

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* *See* extract from *Straits Settlements Gardens' Bulletin*, page No. 421.

Up to the present the attack has been most serious on palms under eighteen months old. Weakly palms suffer most, and large numbers have been so seriously injured as to necessitate supplying. Hand picking on young fields has done much good, but this method cannot be applied to palms of any size, and is expensive and laborious. During six months of last year 385,000 larvæ and adults were thus collected from a field of about 500 acres of twelve-month old palms.

(v) *Coconut spike caterpillar.*—This caterpillar which is the larva of an unidentified moth of the Family Pyralidæ, Sub. Fam. Phycitinæ, is a hitherto unrecorded pest of coconuts which may prove of major importance. The caterpillar attacks both male and female flowers of the spike. The male flowers are attacked first, the anthers being eaten as the flowers open, the dead flowers and frass being then spun together with silk into a dirty looking mass around the branches of the inflorescence and within the spathe. Tunnels ramify through the mass, along which the caterpillars can move with considerable rapidity. In bad attacks there may be scores of caterpillars of various ages in a single spike. When the male flowers on one spike are nearly consumed a few of the caterpillars may bore into and destroy the female flowers, while the remainder, such as are not full-fed, appear to emigrate to the next opening spike. The full grown caterpillar is uniform brownish-drab in colour, seven-eighths of an inch in length, naked of hairs, save for a few short bristles on each segment. Pupation takes place in a roughly constructed cocoon in which dead flowers and fibres are woven in with silk. The cocoons may be on the spathe and dead inflorescence, on the trunk and leaf petiole, or most frequently among the fibrous extensions of the leaf base.

Spikes badly attacked seldom set nuts, even if the female flowers are not bored. Not infrequently the attack may persist for months on a palm, with the result that no crop is obtained for a similar period later. Infection is sporadic, to such an extent that of adjoining palms, one may be clean and carrying a lot of set nuts while the other is ridden with the pest, and sterile.

The only treatment to be recommended at present is to cut off and burn all attacked spikes in a plantation.

Up to the present this pest has been observed only on palms of less than ten years but this is probably due to my opportunities of examination having been mainly among young plantations.

(vi) *Coconut pollen mite.*—A mite of considerable size frequently swarms on the spikes in such numbers that its eggs alone cover patches of several square centimetres. The mites enter the pollen chambers in newly opened male flowers, and feed on the contents. Such of the pollen as is not destroyed becomes massed into heavy lumps, and probably is rendered unfit for pollination of the female flowers.

The damage done can only be judged, so far, from the scanty crop of nuts setting on palms infected with the mite. This pest and the coconut spike caterpillar are frequently found together.

If treatment against the mite proves to be necessary, dusting each spike as it opens with flowers of sulphur, or spraying it with lime-sulphur from a small hand spray, will probably prove most satisfactory. I am of the opinion that these two pests are responsible in certain areas for an annual loss of crop ranging as high as 100 per cent. on individual palms and 30 per cent. on whole fields.

(vii) *Brachartona catoxantha.*—The caterpillars of this moth are a recurrent pest, becoming numerous in the same locality at intervals of time which have been variously stated at two, three, and up to six years. In the interim they are kept in check by parasites, of which a Tachinid fly appears to be the principal; while a fungus, *Botrytis* sp. may also serve as a useful check. *Brachartona* is not confined to the coconut palm, but occurs also on *nibong* and *nipah* leaves, from which attacks in new coconut areas probably originate.

Experiments in control of this pest have shown that it can be artificially controlled by spraying, provided the attack is taken in time, and that the resultant damage to the palms may be almost negligible.

The damage caused by *Brachartona* attack is twofold. The caterpillars when numerous destroy a great deal of the leaf surface by eating away narrow strips of the tissue on the underside of the leaf. In very bad attacks, all except the youngest leaves of the crown may thus be practically destroyed by the caterpillars themselves. More often, however, only a small part of the leaf tissues is actually eaten, and, although this is a serious loss to the plant, provided the remaining green tissue continue functional no marked permanent injury would result. The wounds, however, serve as infection points for such leaf fungi as *Pestalozzia*, and in consequence the whole of the tissue of mildly attacked leaves frequently dies, the leaves turning brown, and falling. By treating the attacked leaves with a fungicide much of this subsequent trouble is prevented.

Spraying with a combined insecticide and fungicide, or applying two distinct sprays, is laborious and expensive especially on palms of any height, and it remains to be seen whether the treatment is warranted by crop saved over the following two years in sprayed as compared with unsprayed areas. I know of no cases of palms being killed outright by *Brachartona*, but the set-back is often very severe.

Brachartona outbreaks vary in severity. They may be over small or large areas, lasting through two generations only, with slight damage, or through several generations, each of increasing virulence, until the parasites are sufficiently numerous again to overcome the pest. At the outbreak of an attack, therefore, it is necessary to consider many factors before determining treatment. The need for artificial control measures is dependent upon the probability of natural checks not operating, and their character must be such as not to militate against the natural enemies of the pest. The nature and prevalence of the parasites must be determined for each attack, and the probable duration of the attack gauged therefrom. The danger of spread and the degree of damage already

done affect the question of undertaking costly treatment for the caterpillars. The fact that leaf fungi thrive in wet weather, and are not likely to cause great infection during drought, must be considered in deciding whether or not to use a fungicide. If treatment of the caterpillars is decided upon, the time and nature of treatment must be regulated to the best advantage of the parasites and may be different for different outbreaks. It is not, therefore, possible at present to lay down any hard and fast rule for treatment of universal application.

(During 1918 a very serious attack of *Brachartona* lasting over seven months has done incalculable injury to coconuts around Batu Gajah, Perak, on an area some four miles long by one mile wide. Coconut planters would do well to take notice of this, and consider the necessity of supplying themselves with spraying apparatus adequate to deal rapidly with large areas. Owing to the great height of most of the attacked palms, it was impossible in this case to spray. Many other methods were tried extensively, the result of which has been more than ever to convince the writer that spraying is the only efficient means of artificial control so far evolved, and that it is at least wise to be prepared to apply this means immediately upon the commencement of an outbreak.)

(viii) *Bag worms.*—The larvæ of various species of Psychid moths have occurred as local pests on coconuts, doing a lot of damage to small areas. The life history and treatment are similar for all the species. The damage is done by the caterpillar which encloses itself in a conical silken case to which it may attach bits of leaf or other protective material. This case is never vacated by the caterpillar, which is almost wholly concealed inside it, thrusting forth only its head and thorax when feeding or moving about. When young, the caterpillars eat small irregular holes in the leaves, but later feed along the edges, consuming large quantities, and giving the attacked leaves a very ragged appearance. When full fed the caterpillars pupate inside the cases, which are attached to thé underside of the leaves, to the rachis, or to the trunk. The male emerges as a winged moth, but the female is wingless and does not leave the pupa case inside which she is fertilized and lays her eggs. The young caterpillars on emergence from the eggs, leave the maternal case and are distributed by wind, spinning a long fine strand of silk at the end of which they may be conveyed considerable distances. Treatment consists of hand picking the larger cases or spraying with a stomach poison for the young caterpillars. As is the case with *Brachartona* all individuals of one generation emerge nearly at the same time.

Pests of other Crops.

(i) *Coffee clearwing moth, Cephonodes hylas.*—Caterpillars of this dangerous pest were taken fairly frequently on coffee and gardenia shrubs and coffee cultivators will be well advised to watch for a recurrence of its attack.

(ii) *Udang ketak, Thalassina anomala (Herbst.).*—This creature is a powerful burrowing Crustacean of large size which is numerous in the mud of tidal areas along the coast. It makes large ramifying burrows many yards in length, and extending in depth at least

to low water level. It appears to derive its nourishment from the excavated mud which is passed through the body and voided at the mouths of the burrows. Hence the pyramids of dried mud which are such a constant feature of the landscape of a muddy coast.

The *Udang ketak* is a nuisance on coconut and other coastal cultivated areas, as its burrows, passing under the bunds, allow ingress to quantities of salt water at high tides. In the Krian rice district it is, however, much more serious, as irrigation water runs to waste through the holes at low tide, while at high tide the water and soil are rendered brackish, and thus deleterious to padi cultivation over considerable areas. Experiments are being carried out by the Irrigation Engineers for controlling *Thalassina* by means of poisons and deterrents in their burrows. So far the only material which has given much success is lime, and the extensive use of this is reputed to be harmful to rice lands.

IDENTITY OF A COCONUT HISPID.

THE following note from the pen of Prof. C. F. Baker of the Philippine Agricultural Department appeared in the *Gardens' Bulletin, Straits Settlements*, Vol. II, No. 1, 4th July, 1918, p. 3:

"Recently, Mr. R. M. Richards, of Caledonia Estate, sent to me specimens of what Peninsular entomologists have been calling *Bronthispa froggattii*, a small but destructive Hispid beetle occurring on coconuts. It can be recognized by its small size, black colour, and red pronotum. *Bronthispa froggattii* was originally described from the Solomon Islands, and since there was some question as to the positive identity of the Malayan form, specimens from Mr. Richards and also specimens which I had taken in Singapore were sent to Dr. Gestro in Genoa, one of the best known authorities on the Hispidæ. Dr. Gestro now replies that he possesses typical specimens of *Bronthispa froggattii* and that our form cannot possibly be associated therewith, on the other hand he states that the Malayan beetle is clearly *Plesispa Reichei* Chap., originally described from Malacca. I do not know how the erroneous determination first got into Peninsular literature."

Plesispa Reichei was first described in 1875 from a single specimen. Whether then it was scarce or not is impossible to ascertain, but it is now far too common. No parasite has yet been obtained from it. It is of course possible that the insect was an importation from elsewhere on coconut seedlings. Should no practical method of artificial control be established, it may become necessary to search for the insect and possible parasites in other countries.

P.B.R.

VULCANIZATION RESEARCHES.

By B. J. Eaton.

THE following is a summary of the vulcanization research work carried out in the Chemical Laboratory of the Agricultural Department during the first half year of 1918:

Effect of Alum Salts as Coagulants.

The principal investigation has been on the effect of different alum salts used as coagulants. The writer has previously shown that common commercial alum (potash alum) when used as a coagulant, has a very deleterious effect on rubber, especially in regard to its effect on the rate of cure. The subject is one of considerable importance, since, especially owing to the rise in price of acetic acid, the use of alum by Asiatic small-holders has, it is believed, increased considerably, and the result, with the comparatively large amount of rubber from Asiatic small-holdings now being manufactured, may be to give a bad name to plantation Para rubber. American manufacturers, who, it is believed, have been large buyers on the Singapore market of rubber from such sources, have previously drawn attention to the subject.

The present investigation was carried out to ascertain whether the different alum salts had a similar effect and the result of the investigation has shown that such is the case. The effect of the following alum salts was investigated:— Potash alum (pure), commercial alum (potash alum), soda alum, ammonia alum and aluminium sulphate. The use of alum salts generally, as coagulants, should therefore be discouraged.

The effect of alum as a retarding agent in vulcanization, and of some other substances, *e.g.*, mineral acids, has not yet been investigated on a scientific basis, *i.e.*, with a view to ascertaining whether the effect is due to the bactericidal or anti-enzyme action of these substances or their effect as direct negative catalysts in vulcanization.

Experiments, however, with certain other reagents to be described below, indicate that these substances behave directly as negative catalysts or retarding agents in vulcanization.

Effect of Certain Chemicals when added to Finished Dry Rubber.

These experiments were carried out in order to test the effect of certain chemicals when added to dry finished raw rubber, as distinct from the use of these or other substances as coagulants. When used as coagulants, the various salts or acids may retard vulcanization in virtue of their bactericidal action on the organisms or enzymes which bring about the changes in raw rubber during the maturation period of six to seven days. By adding these chemicals, however, to the finished rubber, any effect must be due to a neutralization of the effect of the natural accelerator or to a direct negative effect of the chemical added.

The following substances have so far been tested in this manner:—Starch (as a neutral organic adjunct), boracic acid (known to be a bactericide, but in this case, any effect must be a direct chemical action), tannic acid, molybdic acid and phosphotungstic acids used as precipitants of proteins, amines and basic nitrogenous compounds.

All of these substances, with the exception of starch, when added to the extent of 1 to 2 per cent. of the rubber-sulphur mixing had a very marked effect in retarding vulcanization, both in the case of "slab" crêpe and crêpe samples. Generally, the larger amount had a greater effect than the smaller, and the effect appears to be specific, *e.g.*, the vulcanization of the "slab" crêpe is retarded to a certain extent, but is not as slow as the slow curing crêpe which had been treated similarly, *i.e.*, rubbers having different rates of cure due to different amounts of the natural accelerators present, are not all brought to the same degree of slowness in vulcanization.

NOTES ON MALAYAN TERRESTRIAL ORCHIDS.

TERRESTRIAL orchids are widely distributed throughout Malaya and are found growing under various conditions, from open lalang land to dense jungle, both on the plains and on the highest mountains. With the exception of several species, which grow and flower profusely on the railway embankments throughout the Peninsula, ground orchids are but rarely seen by others than collectors. There are, however, a number of species, both of interest to the botanist and horticultural enthusiast.

As early as 1840, *Cypripedium barbatum* was introduced into England from Malacca. Since then many other Malayan species have found their way to Europe and, in the hands of the skilful orchid cultivator, have made no mean contribution to the large collections maintained in public and private establishments. During the past few years, when circumstances allowed, the writer has taken the opportunity of making a collection of terrestrial orchids, primarily for the purpose of drying for herbaria but also to see what species are amenable to cultivation. In making this collection, several persons interested in orchids have given their assistance. It is thought that a few notes regarding the habitat and cultural requirements of these plants will be of interest to horticulturists.

With the opening up of large tracts of jungle for Hevea planting, many districts are almost denuded of native plants. There are but few orchids that grow in rubber clearings, those that do bearing inconspicuous flowers. It is, therefore, very desirable in collecting orchids to remove only what plants are actually required, as though orchids produce innumerable seeds, yet few seeds germinate and reach maturity. As previously stated ground orchids are to be found at all elevations in Malaya, the majority of the finest species grow on the mountain slopes. The limestone formations met with in several parts of the country are the homes of many fine species. Certain orchids, as for example, several species of the genus *Calanthe*, are to be found growing in damp ground adjoining streams in dense jungle at various elevations. Several kinds are to be found growing on the plains on poor soil, such as lalang land or tin tailings. These plants are well-suited for growing as pot plants in sunny positions.

Cultivation.

The majority of terrestrial orchids require careful cultural treatment to keep them in good health and growing vigorously. The collector will naturally keep his eyes open and note the surrounding conditions upon finding an orchid. The three principal factors that govern the successful cultivation of terrestrial orchids are, potting compost, watering and shade. Ground orchids growing, as they do, in such a variety of soils and situations, it is obvious that no hard and fast rule can be laid down as to the best potting medium. The general requirements of each genus are briefly referred to under their respective headings. For most of the strong species such as *Calanthe* and *Phaius*, a mixture of three-fourths turfy loam and one-fourth leaf soil and sand are required. The pots used should be quite clean and crocked one-third the way up. Terrestrial orchids do not require to be raised above the rim of the pot as in the case of epiphytic species.

Watering is of considerable importance in the successful cultivation of orchids. The health of the plants depend to a great extent on the quantity and quality of water used, and on the time and manner it is given. The use of rain-water is to be recommended in the case of all orchids. Many terrestrial orchids require a distinct period of drying off after flowering or the termination of active growth. This is very necessary in the case of deciduous species which lose their leaves. Evergreen species may be kept in a moist condition throughout the year.

Terrestrial Orchid Hybrids.

Malayan terrestrial orchids have received considerable attention from the orchid hybridist in England and elsewhere. In fact one of the first orchid hybrids raised in England, *Calanthe Veitchii*, which flowered in 1859, was the result of a cross between *Calanthe rosea* and *Calanthe vestita*, the latter a native species but having a wide distribution. It is hardly to be expected that any orchid hybrids will be produced in this part of the world. There are, however, a number of very fine hybrids cultivated in Europe. A list of the best of these is appended with the hope that a selection of them may in time be introduced into cultivation in Malaya, the home of their progenitors.

Calanthe Veitchii. (*Calanthe rosea* × *C. vestita.*)

Phaius hybrids—a number of splendid hybrids which should grow well in this country.

Spathoglottis Kewensis (*S. plicata* × *S. Vieillardii*).

„ *Colmanii* (*S. aurea* × *S. Veitchii*).

„ *Veitchii* (*S. aurea* × *Vieillardii*).

Cypripedium Tautzianum (*C. barbatum* × *C. niveum*).

Cypripedium superciliare (*C. barbatum* × *C. superbens*).

The following bi-generic hybrids are also worthy of notice:

Phaio-Calanthe irroratus (*Phaius grandifolius* × *Calanthe vestita*).

Phaio-Cymbidium Chardwarense (*Cymbidium giganteum* × *Phaius Wallichii*).

List of the best Malayan Terrestrial Orchids for Cultivation.

This list has been confined to narrow limits to include those species only that are worth cultivating and fairly easy to grow. There are many others of considerable botanical interest and worth growing on account of their curious structure or quaint appearance. A few species are included that are hardly terrestrials in the accepted sense but grow well if treated as such.

Spathoglottis.

The improved form of this common orchid, *Spathoglottis plicata*, is widely grown as a pot plant. There are considerable variations of colour met with in the flowers, from crimson to pure white (*Spathoglottis plicata alba*). The wild plant is found in open places throughout the Peninsula ascending the hills to high elevations,

though more commonly met with on the plains. It is a common plant on the railway embankments. The white form is less frequently seen, though fairly numerous in several districts.

The leaves are two to three feet long, narrow. The raceme is six to nine inches long, many flowered, borne on a scape two to three feet high. The variety *alba* is a smaller plant. The flowers are one inch in diameter, produced throughout the year in great profusion. The pseudo-bulbs are covered with the fibres of the old leaves.

The cultural requirements of these plants are simple. They should be grown in sandy soil in full sunlight and receive plenty of water when fully established in the pots. The yellow flowered species, *Spathoglottis aurea*, found in open situations on the highest hills, does not grow well on the plains, at least this is the experience of the writer.

PHAIUS.

Large terrestrial herbs with thinly plaited leaves and showy flowers. The scape is from two to four feet tall terminating in a raceme of numerous large flowers. *Phaius Wallichii* is the only species met with on the plains, where it grows on the edges of jungle, and is an excellent plant for pot cultivation. The flowers are four to five inches across, white outside, orange and chocolate-brown within. It requires a sandy loam with plenty of space for root development and may be given frequent applications of manure-water when coming into flower. The plants show buds during August and are in full flower in September and October. *Phaius callosus* is a finer species, with pinkish flowers, found wild in dense forests on rocks and the sides of streams, at elevations of 4,000 feet or so. The writer has often collected this plant at Maxwell Hill, Taiping, Perak. It flowers during the latter months of the year. On the plains, under cultivation, its behaviour is often unsatisfactory and it cannot be classed for general cultivation as in the case of *Phaius Wallichii*.

A small species, *Phaius pallidus*, with racemes produced from a leafy stem also occurs on some of the hills. The writer has collected a few plants at Maxwell Hill, Taiping, at 3,500 feet. The flowers are pale yellow and about two inches in diameter. It is a weak grower but an interesting plant.

CALANTHE.

There are nine wild species found in the Peninsula, of which four are well worth cultivating. The genus is divided into two divisions:

(1) Flower scape appearing with the leaves { *Calanthe veratrifolia.* / *Calanthe Ceciliae.*

(2) Scapes appearing after the leaves { *Calanthe vestita.* / *Calanthe rubens.*

The plants in the first division are evergreen and should be grown on throughout the year. Those in the second are deciduous and require a long rest, with little watering, after flowering. Loam and leaf soil with a sprinkling of sand makes a good compost for all species. Good drainage is necessary, especially with the deciduous species.

Calanthe veratrifolia is a beautiful plant with numerous white flowers, three-quarters of an inch in diameter, on a scape one to two feet long. It flowers in the later months of the year. A fine orchid for pot culture. *Calanthe Ceciliae* is not often seen under cultivation, though a very desirable plant. It occurs on rocks and in damp places in dense jungle. The writer has seen large numbers of these plants growing within a few miles of Seremban, Negri Sembilan. The stem is short with large oval leaves. The scape is one foot or more high bearing a crowded raceme of flowers, one inch across. The flowers are white tinted with violet. This plant grows well in a tub in a shady position.

Calanthe vestita has been found on the limestone rocks near Kuala Lumpur, Selangor. The pseudo-bulbs are large, two to five inches long. The leaves are broad, about 15 inches long, and produced after the plant has flowered. The flowers are large, white, and produced on a scape from the side of the pseudo-bulb. *Calanthe rubens* is a much smaller plant with white or rose flowers. It is endemic to the Langkawi Islands.

ARUNDINA.

A small genus of terrestrials with woody terete stems, and narrow grassy leaves. *Arundina speciosa* is found growing on rocks in streams in many parts of the Peninsula. It is of easy cultivation and should be grown in a large pot or tub in full sunlight. When fully established it may be given plenty of manure; a top dressing of goats' manure has been found satisfactory. The flowers, in the form of a raceme, are rose colour shading to pink and about two inches long. It may be easily propagated by removing the young plants that form on the stems. The species may be grown in open beds in Perak but here in Kuala Lumpur, better success has been obtained by growing it in large Chinese ornamental pots.

EULOPHIA.

There are three native species but all have rather inconspicuous flowers. *Eulophia squalida* has the largest flowers which open in September or October. The sepals are brownish-green and narrow. The petals form a hood, white tinted with pink. The lip is crisped, pale pink in colour with yellow veins. This orchid grows in open lalang land and is fairly common in some districts. It succeeds well as a pot plant and flowers regularly every year. *Eulophia graminea* is a common plant in open places and often spreads to young rubber clearings. It is known to the Malays as "Bawang Hantu." Though the individual flowers are small, it makes a good pot plant. *Eulophia Keithii*, with almost entirely green flowers $1\frac{1}{3}$ inches in diameter, is an uncommon plant. It flowers in May and June. A number of specimens in the Public Gardens, Kuala Lumpur, received from the Langkawi Islands, flower well annually and remain in perfect health though they have been in pots for over five years. All species may be increased by division.

GRAMMATOPHYLLUM.

The giant orchid, *Grammatophyllum speciosum*, is an epiphyte but may be grown successfully on the ground. It is a noble plant and when in flower is a magnificent object. A large plant produces a

number of stems from six to ten feet long with numerous narrow leaves. The flower spikes are often ten feet long and, under cultivation, may bear over 100 flowers. Ridley, writing of this orchid, refers to a specimen with 64 flower spikes having a total of about 8,000 flowers. The individual flower is about five inches in diameter with an ochre-yellow ground, blotched and spotted with dull purple. A young plant in the Gardens, Kuala Lumpur, is flowering at the time of writing (August). It has seven flowering spikes, each spike bearing about 80 flowers.

The plant has a rather wide distribution and in the Malay Peninsula is fairly common. Its favourite position is on a tree overhanging a stream but it is often found on tall trees in dense jungle. The Malays call the plant "Bunga bidadari;" it is also known in Pahang as "Ekor gajah," a name that well describes the old stems after flowering. It is a fine plant for growing on an open lawn. The plant should be placed on a mound of broken bricks, rocks and jungle soil. The base should be only slightly covered with earth and should be raised at least one foot from the ground.

BROMHEADIA.

Bromheadia palustris is a common orchid in open grassy places and is also found growing on rocks in damp spots in jungle, plants in the latter situation attain a larger size than in the former. The stems are tall and stiff, reaching a height of six feet. The flowers are white tinted, pink and fragrant. They open singly on the raceme. It is a good plant for pot culture or it may be planted out in a bed of sandy soil.

VANDA.

Vanda Hookeriana is found in Perak and elsewhere climbing over low bushes in open swamps. It should be grown up a post in full sunlight. The large pale rose flowers are $2\frac{1}{2}$ to 3 inches in diameter. The leaves are cylindrical and tapering. *Vanda Miss Joaquim* is a handsome hybrid between *Vanda Hookeriana* and *Vanda teres*, it is of intermediate habit and very floriferous. During dry weather a mulch of leaves around the stems of these orchids is beneficial.

RENANTHERA.

The scorpion orchid is well known and cultivated in many gardens. Its large musk-scented flowers are very useful for table decoration. It is found wild in parts of Perak and is known to science as *Renanthera arachnitis*. The cultivation of this plant is the same as in the case of the Vandas. *Renanthera Maingayi* is a similar plant but has pink and white flowers.

HABENARIA.

Habenaria carnea is a lovely little plant hailing from the Langkawi Islands. The scape attains a maximum height of one foot with a number of large rose pink or white flowers, an inch or so across. It flowers in April and May and succeeds well in a compost of loam and wood-ashes with the addition of course sand.

CYPRIPEDIUM.

There are two species of this genus that may be successfully cultivated in pots. *Cypripedium niveum* is found on limestone rocks on the Langkawi Islands. The leaves are green, marked with darker blotches with dull purple beneath. The scape is about six inches high bearing from one to three large white flowers dotted with light purple. The plant should be grown in sandy loam and it is essential to see that good drainage is given. It should be grown in half shade and requires plenty of water before flowering which commences in March, continuing for a considerable period.

Cypripedium barbatum is a fine plant met with in many districts in the Peninsula. It grows on rocks and slopes on the edges of streams ascending to an altitude of 4,000 feet. The scape is one foot tall bearing one to two flowers. These are three inches across and very showy. The upper sepal is broad, white with purple veins. The petals are greenish brown with a number of black warts along the edge. The large lip is reddish purple. This species can be grown in either pots or baskets. It likes plenty of water when growing and shading from strong sunlight. The soil should contain plenty of humus and be loosely placed in the pot. The writer has usually found this plant flowering in November and December but when cultivated its flowering season is irregular. This species has been used extensively as a parent by orchid breeders in Europe.

J. N. Milsum.

BANANA FLOUR AND OTHER FLOURS FROM TROPICAL STARCHY PRODUCTS WITH NOTES ON BANANA CULTIVATION.

By B. J. Eaton.

IN connection with the interest now being taken in the cultivation of food-stuffs in this and other tropical countries, attention has been directed to the preparation of local substitutes for ordinary wheaten flour and some interest appears to be taken in the subject by writers in the local press and certain popular technical journals.

At the same time erroneous ideas are held as to the nutritive value, particularly of the dried banana, in comparison with that of wheaten flour.

In one enquiry addressed to the Department of Agriculture the applicant understands that scientific investigation has shown that banana flour is thirty-five times as nutritious as ordinary wheaten flour. This impression, however, is quite erroneous and probably refers to the nutritive value of the fruit in comparison with other fruits, most of which are valuable as adjuncts to diets, rather than of direct nutritive value, although the carbohydrate (sugar) contents are of direct nutritive value.

In general, however, very few fruits (using the term in the popular sense) contain any quantity of the valuable nitrogenous constituents (proteins) present in cereals such as wheat, barley or maize, whereas the banana does. It will be seen that banana flour from the point of view of nutritive value (especially in respect of protein content) is lower even than rice flour.

The following table gives the results of analyses of banana flour analysed by the writer in 1906 in England, together with comparative analyses of flours from wheat, barley, rice, maize and millet:

—	Banana flour.		Wheat flour.	Barley flour.	Rice flour.	Maize flour.	Millet flour.
	Sample No. 1.	Sample No. 2.					
Moisture ... ...(per cent.)	9.60	12.06	16.5	15.06	14.41	12.5	11.26
Fat (ether extract) „	0.32	0.44	1.2	1.71	0.51	3.6	3 56
Proteins (nitrogenous matter) (= N × 6.25) „	3.00	4.80	12.0	11.75	6.94	9.5	11.29
Fibre ... ... „	0.79	0.70	...	0.11	0.08	2.0	4.25
Carbohydrates (starch, etc.) ... ... „	83.54	77.87	69.6	70.90	77.61	70.7	66.15
Sugars (glucose) .. „	0.94	1.84	...	...	...	...	1.18
Mineral ash ... „	1.81	2.29	0.7	0.47	0.45	1.7	2.31
Phosphoric acid P_2O_5 in flour ... ... „	0.13	0.17					

It will be seen from the above table that the protein content of the banana flour is very low compared with the other flours. In 1907, these banana flours were valued at 16*s.*—20*s.* per cwt. in London and the dried bananas from which they were prepared at 18*s.* per cwt. In the Seychelles the flour is prepared by drying in special apparatus at 65°—70°C. for 18 hours.

Dietetic Values.

In the light of modern research on diets, particularly the work carried out in this and other countries on beri-beri, scurvy, pellagra and other diseases, which have been proved in certain cases to be due to a deficiency of certain constituents, named vitamines, in the diet, our views on diet values have been modified considerably during the last ten years. Important and valuable work on the chemical nature and dietetic value of the amino acids constituting the different animal and vegetable proteins is also being carried out at the present time, although not yet sufficiently advanced to enable us to use the results for analytical purposes in the investigation of the dietetic value of foods.

Tropical starchy products.—Apart from the tropical cereals—millet and rice—the substitutes for flour consist chiefly of the flours prepared from roots or tubers such as cassava (tapioca), yams and sweet potatoes, which may be compared with the ordinary potato in dietetic value, rather than with flours from wheat or other cereals. Similar remarks apply to sago obtained from the pith of the sago palm. All of these flours consist essentially of starch, with none or a very low protein content, and consequently require the addition of other nitrogenous food products, to supply the necessary protein required for a well-balanced diet. Fortunately these proteins could, if necessary, be supplied by the addition of other tropical products, rich in such constituents, *e.g.*, ground-nuts or possibly well-prepared coconut residues. Similarly the necessary edible fats could be supplied and prepared locally from coconuts or ground-nuts.

Preparation of Banana Flour.

The following directions for the preparation of banana flour are given by Verteuil in Trinidad (*Agricultural News*, Vol. XVII, No. 414, 9th March, 1918). Any kind of banana or plantain is suitable. For economic purposes the variety which produces the largest weight of fruit (excluding the skin) should be grown, apart from other considerations, such as liability to attack by pests and diseases. No definite information appears to be available in this country as to the most suitable varieties from the point of view of yield.

J. Bruce, writing in the *Tin and Rubber Journal*, Vol. VII, No. 8, 30th April, 1918, recommends the Pisang Raja, on account of the size of its bunches, and size of fruit and high productivity, as the only economical variety for flour.

The bunches should be cut when about three-quarters full, otherwise the fruit will become too ripe and the starch be converted largely to sugars.

The bananas are peeled, sliced thinly with a nickel, bamboo or other knife which does not darken the fruit, and the slices laid on wooden trays in the sun to dry. Under good conditions the drying takes two to three days.

The dried slices are crushed in a corn-mill or pounded in a mortar and sifted through fine muslin.

On a large commercial scale, artificial drying is resorted to, which is probably carried out preferably in vacuum driers at a low temperature, or in special chambers or rooms in which the peeled and sliced bananas are placed on trays on endless travelling belts or conveyers and dried by forcing or drawing hot air through the chambers.

Banana meal or flour is nutritious and very digestible and is used largely in England as a food for invalids and infants.

Good bread can be made by mixing it with equal parts of wheaten flour. The writer and his wife have also prepared excellent cakes with banana flour; the chief drawback, when using the flour alone, is its "shortness" due to the absence of any protein similar to the gluten of wheat flour.

Banana meal may also be cooked and eaten as porridge. In the form of milk puddings, it may be prepared similar to rice and other milk puddings and is very palatable. As a substitute for milk in these and other dishes, the white emulsion of oil and water, prepared by grating the fresh coconut, diluting with water and squeezing the mixture through muslin, as in the preparation of "Gula Malacca," may also be utilized.

Other Flours from Tropical Products.

Flours may be prepared in a similar manner from sweet potatoes, yams, cassava, etc.; excellent bread, cakes, etc., can also be prepared by the use of such flours in a similar manner.

Preparation of Potato Bread.

A method of preparing potato bread, consisting of a mixture of potatoes and ordinary wheaten flour is given in *The Garden*, Vol. LXXXII, No. 2425 of 11th May, 1918.

Since this method should be applicable to such products as cassava, yams and sweet potatoes, it is quoted below.

The quantities used are in the proportion of 7 lbs. of plain wheat flour, $2\frac{1}{2}$ lbs. of potatoes (cooked and sieved), 1 oz. of yeast, $1\frac{1}{2}$ oz. of salt, 1 tablespoonful of sugar and 3 pints of tepid water. (*Note.*—Instead of employing yeast for the fermentation process, fermented toddy, as used in this and other tropical countries for fermenting dough, may be employed. Fermented toddy contains large quantities of a yeast.)

The flour is sifted into a sufficiently large basin to allow for the increase of volume due to the fermentation; the sifting is done to avoid large lumps and because the bread is made "lighter" thereby. The salt is then sifted into the flour. The potatoes are steamed in their skins, preferably to boiling in water, and the cooked potatoes are rubbed through a sieve by means of a wooden spoon, after removing the skins, and mixed very thoroughly with the flour. Fresh hot cooked potatoes should be used in order to warm the flour.

The yeast is mixed with about a teacupful of warm water. (*Note.*—Toddy can be warmed only and does not require mixing with more water.) The warming is carried out to assist the fermentation, which is inhibited by cold, but in this country, a temperature of about 100° Fah. should be sufficient. Add the sugar to the mixture of yeast and water (or toddy) and pour the mixture into a well, formed in the centre of the flour and potato mixture. Cover with a cloth and place in a warm place for 15 — 20 minutes. When the "sponge" (the mixture of flour, potatoes, yeast, etc.) has "risen," mix in the remainder of the tepid water and work by means of the hands into a smooth dough. The mixing should be as soft as it can be for handling, to enable it to "rise" sooner and higher and be lighter and more digestible. Sprinkle a smooth board with flour and knead the dough for about 10 minutes; replace in the basin, which has been sprinkled with flour and sprinkle more flour on the surface of the dough; cover the whole with a cloth and stand in a warm place for about two hours. The dough should have risen to about twice the original volume. Turn out again on the board and knead thoroughly, since this is very important, and makes the pores fine and regular. The kneading should occupy at least 20 minutes. In making the soft dough, it will be found that all the flour mixture is not used at first and this may be added to facilitate the kneading.

The dough is then divided up into four or five parts, again kneaded and placed in warm greased tins or on warm floured baking-sheets covered with cloth and allowed to stand in a warm place for 15 — 20 minutes, and then placed in an oven which is not too hot and baked steadily for about 20 minutes, avoiding the opening of the oven during this period. If the "rise" is too rapid and the crust forms too quickly, cover with clean paper, till ready to "brown." Bake for 45 — 60 minutes and remove the loaves and place on sieves to cool.

Storage of Sweet Potatoes, Vegetables, Fruit, Etc.

It may be necessary in some cases to store certain food crops for a period and considerable difficulties are encountered in this problem, especially in tropical countries.

Useful suggestions are given in a paper by A. F. Miller read before a district agricultural society in Trinidad and published in *The Agricultural News*, Vol. XVII, No. 416, 6th April, 1918.

These recommendations appear to be very similar to the methods adopted for storing potatoes, mangolds and other root crops, during the winter in England.

The method is that of "hilling" and "banking," preferably carried out under a shed or other means adopted to prevent exposure to weather.

An area of dried ground is laid out, with a ditch round the space required. A good layer of dry trash or straw is spread on the area, and the roots or other produce to be stored are placed on top in the form of a mound of triangular section; the heap is covered with a thick layer of straw and then with damp earth, packing firmly with a spade or other suitable implement.

In the case of very large quantities, a zinc pipe perforated with one inch holes should be placed upright through the centre of the heap, to allow surface moisture to escape and to keep the heap cool while the produce is "sweating."

On a small scale, empty cement or other small barrels can be used; a 3-inch layer of dry sand is placed at the bottom, then a layer of the roots or tubers, another layer of sand and so on to the top, putting a layer of sand about four inches deep on top. The tubers are said to keep quite sound for a period of six months and the barrels can be opened up as required.

This method is applicable to potatoes, sweet potatoes, yams and other root crops except cassava. It may also be employed in the storage of many fruits, *e. g.*, mangoes and limes and vegetables such as cucumbers.

The fruit for storage should be picked in a green-ripe condition. In the case of cassava (tapioca), apart from the preparation of the different kinds of tapioca (seed, pearl and flour) preservation for table use can be carried out by slicing and sun-drying and finally baking in dry ovens.

Remarks.—It will be observed that in all the above recommendations for the preparation of bread, cakes, etc., the substituted flours are mixed with a certain proportion of ordinary wheat flour. This is on account of the fact that these tuber or root flours consist almost entirely of starch with little or no protein and certainly none of the gluten (a protein) which is contained in wheat flour and to which its binding and cohesive properties are due. Corn flour (from maize) can be substituted for wheat flour.

Notes on the Cultivation of Bananas.

The following notes are not intended to be a guide to banana cultivation but consist of hints on improvement in the soil, when necessary, for higher yields.

It has been shown by several investigators that the banana takes up large quantities of potash from the soil (*vide Agricultural Bulletin*, Vol. V, No. 4, January, 1917).

Experiments carried out by Brunnich in Queensland (*vide Transactions of the Third International Congress of Tropical Agriculture*, Vol. II, 1917) have also shown that the banana responds very readily to manuring with potash fertilizers especially on exhausted land and that large quantities of potash can be applied with advantage and with commercial success, the increases in yields of fruit compensating handsomely for the expenditure on the fertilizer and its cost of application.

The banana also flourishes best on soils containing a fairly high percentage of organic matter and soil which is moist.

All organic refuse, therefore, and ashes from burning wood, etc., which contain potash, should be applied as fertilizers when available and all banana refuse, skins of the fruit, etc., should be again dug into the soil for a similar purpose.

The banana plant requires a well-drained heavy soil, containing a fair amount of humus and good amounts of potash, lime and phosphoric acid in an available condition, in order to get the best results.

Irrigation, heavy manuring with organic fertilizers, dung, etc., have given excellent results and potash manuring has also been applied successfully in India. Liming experiments in different countries have also proved the value of this fertilizer and potash is pre-eminently required.

Green manuring is also practised with success, but the green manures grown should be kept away from the stools, in order to avoid robbing the banana plants of moisture.

No other cultivated plant, according to one authority, exhausts the soil to such an extent as bananas and this is borne out by soil analyses, especially in respect of potash content.

A fair crop of bananas removes 123 lbs. of potash, 12.5 lbs. of phosphoric acid and 43.7 lbs. of nitrogen per acre from the soil and the stalks left on the ground contain 150 lbs. of potash, 6 lbs. of phosphoric acid and 41.4 lbs. of nitrogen.

With regard to potash, this means that 273 lbs. of potash or say 5 cwts. of sulphate of potash per acre must be readily available in the soil to produce a good growth and crop.

The standard fertilizer used in Queensland contains 160 lbs. of potash, 80 lbs. of phosphoric acid and 40 lbs. of nitrogen, applied per acre twice a year to normal crops and in double quantities to crops on exhausted land.

The first lot of manure may be applied to the holes when planting (holing 12 feet apart) and the subsequent applications as top dressings and hoed under.

It is recommended in old plantations to apply half the fertilizer round the stools in holes, made by a crowbar to a depth of 18—24 ins. round the plant and three to five feet from the plant and the remainder as a top-dressing.

A striking feature on poor land is the formation of "blind bunches." In the Queensland experiments, which have proved very successful, nearly two tons of fertilizers have been applied annually, the cost amounting to £26 per acre and when lime was also applied, to as much as £29 per acre. The average yield on the plots with this application was 457 bunches containing 4,330 dozen fruits of a value of £54 per acre, which shows big increases over plots to which half the amount of fertilizer was applied and still more over non-manured plots.

Potash may be applied as sulphate or in other forms, phosphoric acid as basic slag or superphosphate and nitrogen as dried blood or nitrate of lime. Incomplete fertilizers, without potash, barely pay for the cost of the fertilizer.

The following figures illustrate the value of fertilizers:

Application of manure.	Nil.	P.N.	K.P.N.	2 (K.P.N.)
	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Cost of manure per acre	Nil	9 8 6	12 6 6	23 4 0
Value of banana crop per acre	28 11 9	39 3 0	67 2 3	55 15 2

(*Note.*—K. = Potash. N. = Nitrogen. P. = Phosphoric acid.)

These heavy manurial applications do not affect the physical character of the soil, owing to the utilization of the fertilizer by the plant.

REPORT OF THE COMMITTEE OF THE PRIVY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.

THE establishment of a Committee of the Privy Council for scientific and industrial research was made by Order in Council in July, 1915, and the first report of the work of this Committee for 1915-1916 together with the opinions expressed and the recommendations made in that report are of great interest and importance.

This abstract of the report has been made, in the hope that those who have little acquaintance or real knowledge of the methods and nature of scientific research, will acquire some knowledge of its spirit and aims.

The importance of scientific research to our great industries has been recognized for years by those who, like the late Professor Meldola, have foreseen the circumstances under which the British nation would be placed in the event of such a war as is now taking place. Unfortunately, however, many factors, a large number of which could have been eliminated or overcome, have prevented any official recognition of or support for scientific and industrial research, till we found ourselves involved in war. In spite, however, of our unpreparedness in this as in other respects, substantial progress has already been made, thanks largely to the patriotic assistance which has been rendered by many well-known scientists in Great Britain.

Object and Aims of the Committee.

The Advisory Council of the Privy Council for scientific and industrial research contains the names of leading scientists in various branches of industry and Standing Committees for special industries such as engineering, metallurgy and mining have also been constituted.

The primary object and aims of the Advisory Committee are:

(1) to institute specific researches;

(2) to establish or develop special institutions or departments of existing institutions for the scientific study of problems affecting particular industries and trades;

(3) to establish and award research studentships and fellowships.

Historical.

The first official recognition of the need of a scientific research institute for special purposes was the inauguration of the National Physical Laboratory in 1900. In opening this institution His Majesty the King, then Prince of Wales, said "I believe that in the National Physical Laboratory we have the first instance of the State taking part in scientific research. The object of the scheme is, I understand, to bring scientific knowledge to bear practically upon our everyday industrial and commercial life, to break down the barrier between theory and practice, to effect a union between science and commerce. This afternoon's ceremony is not merely

a meeting of the representatives of an ancient and world-renowned scientific society (*N. B.*—The Royal Society) for the purpose of taking over a new theatre of investigation and research. Is it not more than this? Does it not show in a practical way that the nation is beginning to recognize that if her commercial supremacy is to be maintained, greater facilities must be given for furthering the application of science to commerce and manufacture?"

This laboratory with a capital grant of £13,000 and an annual grant of £4,000 for five years (increased gradually to £7,000 per annum in 1908-9) has done excellent work, but the Council suggests that much more might have been done had it been endowed with a sum anything like the annual grant of £100,000 which the American Bureau of Standards receives for development and maintenance from the U.S.A. Government.

The Engineering Standards Committee inaugurated in 1901 by the Council of the Institution of Civil Engineers and later including representatives of all the principal engineering institutions, has also done excellent work in connection with industries.

The Imperial Institute founded in 1887 and reconstructed in 1902 has also carried out extremely useful work in connection with the raw products of the Empire and their utilization.

The foundation of the Imperial College of Science and Technology and the grant of a Royal Charter to that institute marked a further stage in the realization of the national needs for scientific training and research. In addition the development of the mechanical sciences laboratory at Cambridge had grown into an important engineering department and Oxford, with some hesitation, had followed the sister university. The London colleges, first in the field of applied sciences had been retarded by various causes and the provincial institutions which owed their foundation and growth to the needs of local industries had become independent universities, while great technical colleges such as those at Manchester and Glasgow had become of great importance. All these, however, unlike the National Physical Laboratory and the Imperial College, were not due to national effort.

It was realized, however, that much was needed in other directions; other machinery and additional State assistance were absolutely necessary to promote and organize scientific research with a view to its application to trade and industry; but sad to relate, it needed the shock of a great war to make the need manifest.

The outbreak of war found us unable to produce at home many essential materials and articles. For instance, we were making only two dozen kinds of optical glass out of over a hundred made by our enemies; we could hardly make a tithe of the various dye-stuffs needed for our large textile industries with an annual output worth over £250,000,000 per year; we were dependent on Germany for magnetos, countless drugs and pharmaceutical preparations, for the tungsten needed by our great steel-makers and for the zinc smelted from the ores produced by our own Empire.

Such then were a few of the needs which brought into existence the first Committee under the Chairmanship of Lord Haldane and appointed by the Board of Trade in 1914, to devise means and

organization for producing dye-stuffs and supplies of chemical products and the resultant formation of a company for the manufacture of dye-stuffs with a capital of £3,000,000 with a Treasury advance up to £1,500,000 secured by debentures together with a grant of £100,000 to the company, spread over ten years, for research.

The Government Scheme.

The next move was made definitely in May, 1915, when the Presidents of the Boards of Trade and Education received a deputation from the Royal Society and other learned societies interested in the various branches of chemistry, urging "Government assistance for scientific research for industrial purposes, the establishment of closer relationships between manufacturers and scientific workers and teachers and the establishment of a National Chemical Advisory Committee for these purposes."

The two Presidents were in a position to state that Government proposed to establish machinery with wider powers than had been suggested so as to encourage research in all sciences affecting industries and shortly afterwards the President of the Board of Education announced the impending appointment of an Advisory Council for the purpose, and a comprehensive improvement in our educational system.

This Advisory Council became an accomplished fact shortly after the formation of the Coalition Government in June, 1915, and met for the first time in August, 1915, since which time it has held 16 meetings in addition to numerous meetings of sub-committees.

The State had thus recognized the necessity of organizing the national brain power in the interests of the nation at peace. The necessity of the central control of our machinery for war had been obvious for centuries, but the essential unity of knowledge which supports both the military and industrial efforts of the country was not generally understood till the present war revealed it in so many directions as to bring it home to all.

War has remained as much an art as ever, but its instruments, originally the work of the craftsman and artist, are now not only forged by the man of science, but need a scientific training for their effective use. This is equally true of the weapons of industry. The brains, even the very processes, which to-day are necessary to the output of munitions were yesterday needed and will be needed again to-morrow, for the arts of peace.

The report continues that we cannot hope to improvise an effective system at the moment when hostilities cease and the difficult period of reconstruction begins, hence the necessity for immediate action, in spite of the difficulties involved in time of war.

It is obvious that in framing its recommendations and initiating work, the Council, as the report states, has had to consider the relative urgency of problems requiring solution, the supply of trained researchers available, and the material facilities in the form of laboratories and equipment which are available. Such a scheme must be elastic and may be modified from year to year, although a considered progressive programme and policy was essential.

The Council decided to give science in its application to industry precedence over pure science, although they are under no misapprehension as to the relations between pure and applied science. Huxley is quoted as saying "It has been said that what people call applied science is nothing but the application of pure science to particular problems." Properly speaking, this is true, there are not two kinds of sciences. At the same time the Council realized that they had to deal with the practical business world in whose eyes a real distinction seems to exist between pure and applied science (cf. the distinction which is inferred when the layman speaks of the scientific and the practical man. B.J.E.).

The average manufacturer is impressed with the importance of quick returns; he cannot afford to wait. The managing director of one firm informed the Council that he had no interest in research which did not produce results within a year. No doubt, states the report, there are firms more enlightened than this, great enterprises which spend lavishly on fundamental investigations which will, if successful, not merely remove a hitch, or improve output but reveal the exact nature of a process and give the manufacturer assured control of his material.

Yet there is a natural and obvious reason for the scepticism of the average business man. Apart from the long period of work and preparation which a properly organized research laboratory attached to a factory involves before important results can be looked for and apart from the risks that an unsuitable director of such a laboratory may involve a firm in heavy pecuniary loss, there is the plain fact that the difficulties which present themselves to manufacturers or merchants, seldom afford an indication of the true nature of the problem to be solved. They are generally secondary in their nature and a direct attack on them is likely to be as empirical as the symptomatic treatment of disease.

Thus such quick-result enquiries as the manufacturer is induced to make are very likely to be fruitless and to reduce his enthusiasm for science still further.

She finds too few suitors in our industries for she is a mistress who reserves her favours for a complete and single-hearted devotion.

Another important consideration also compelled the Council to begin with research of directly industrial application—*viz.*, the fact that the universities, which are the natural homes of research in pure science, were depleted of students and teachers by the war.

The Council realized that the problems with which it had to deal were not susceptible of rapid and dramatic solution and that the successful organization of research on a national scale would take longer than the establishment of a good works laboratory—which itself is a long business at best. The only hopeful line of action appeared to be a period of careful enquiry and consultation, followed by a gradual but systematic attack on a wide and carefully selected point, instead of concentrating on the rapid initiation of one or two far-reaching proposals likely to attract wider attention and to improve the outlook in one or other of our greatest industries only.

(1).—Aid to Existing Researches.

Enquiries by the Council showed that certain researches in progress, being conducted by professional associations were in jeopardy of abandonment owing to lack of funds, and they decided to support these by grants to the societies concerned and in one case, in negotiation with the War Office, obtained the release of an investigator from military duties and improved the financial and scientific conditions of his work.

Conferences with Professional and other Societies.

Representatives of the Royal and Chemical Societies and all the principal engineering societies have been consulted by the Council as well as the following important professional societies, Institute of Chemistry, Society of Chemical Industry, Society of Public Analysts, Society of Dyers and Colourists, Royal Institution of British Architects and Faraday Society and in addition several trade associations such as the British Electrical and Allied Manufacturers' Association, Silk Association, Staffordshire Pottery Manufacturers' Association and Federation of Master Printers and valuable results thereby obtained. The Council observes that the most highly organized industries are those which have made the most use of scientific research and are, therefore, most ready for, though less in need of encouragement and help. The engineering trades, with their attendant professional societies have long been alive to the need and value of scientific research while the chemical trades have been divided and individual in outlook and the professional chemical societies have had neither the influence nor means necessary for carrying out research in connection with such industries.

The textile trades are highly organized on the economic side but have made little progress in the systematic use of science, which has been left to the dyers and dye-stuff manufacturers or the engineers who supply their machinery, without much care as to the nationality of either.

Paper manufacturers are in the same position. Already, however, there are signs of change and textile research into the electrification of fibres during manufacture is proceeding at Leeds University with funds provided by the Textile Institute and proposals are before the Council for fundamental researches into the cellulose which forms the basic material of the cotton and paper trades.

Register of Researches.

The Council has also invited the assistance of universities and technical colleges in the formation of a register of researches in progress and the conditions and financial needs of such researches. An enquiry into the character of the provisions made for research in our higher educational institutions is also being made.

Endeavours are also being made to induce firms in some industries to assist progress by giving information in confidence of the problems they have in hand or contemplation and the Council states that there are indications that useful co-operation in this respect may be obtained.

Manufacturers are beginning to realize that their most dangerous rivals are not their fellow countrymen in the same trade but powerful enemy combinations supported by every device of trade and tariff which their governments can provide. Co-operative research, at its greatest, will leave ample room for individual initiative and ability in the application of its results. Co-operation, states the report, is not the negation of individual effort; it raises initiative to a higher power.

Aid to Educational Institutions.

At the present time, apart from women workers, the medically unfit, and those specially retained for war work, all advanced students in the faculties of science and technology are working for the Ministry of Munitions, the Admiralty or the War Office. Any assistance granted to educational institutions or to individual workers in such institutions is not to relieve any funds ordinarily available, so that the productivity of individual researchers might be increased and to avoid the diminution of the flow of private benefactions for research. Nothing, says the Council, could show more lamentably and honourably clear, the services of the universities to the country than the lists which have been received from institutions as to the research which is being carried on. The Council hopes by co-operation to bring more reality into these academic laboratories which are dominated by the text-book and the syllabus of examination. In the pursuit of new knowledge in pure science co-operation is not always essential—indeed the existence of different schools of thought and the independent attacks which result from them are positive advantages, but practically at the present time in industrial research it is essential that different workers should be kept in touch with each other's progress. Something in this respect has already been achieved in connection with researches on steam nozzles and optical glass. It is realized also that the problem of attacking definite industrial problems must not be pushed too far in educational institutions except as stimulants to general training.

Pure science, however, has owed much to observations, suggestions and difficulties derived from activities external to the laboratory and it is the desire of the Council to order the relations of workers in pure science to the industries around them that they may receive the stimulus of a wider outlook than is always attainable under the limitations of an academic system of syllabus and examination, and thus to create such an atmosphere; that the new generation of students will cease to draw a distinction between "theory" and "practice" and technologists of all ranks will through them attain to the view that sound practice is only theory tempered by compromise. Links between the professional societies, the universities and manufacturers are also being forged.

Formation of Standing Committees.

The necessity of Standing Committees to deal with particular branches of science was soon realized by the Council and three have already been formed for metallurgy, with special sections on ferrous and non-ferrous metallurgy, engineering and mining with a section on the mining of iron, coal and hydrocarbons and another section on minerals other than the above. These Committees are

nominated by professional societies and by the Council. It will be necessary to form other such Committees later, but up to the present special industries have been dealt with by small special Committees of the Council itself. The Council considers it unlikely that a single chemical Committee, with the large number of sections necessary, could be usefully established at present and that a preferable procedure will be the formation of Standing Committees for particular branches of chemical trade, *e.g.*, (1) fuel, (2) rubber, (3) cotton and paper, (4) textiles, with special sections for cotton, wool and silk.

Parallel Movements in the World of Science and Industry.

The action of the Government in setting up this machinery was accompanied if not instigated, by discussion and debate in the public press and the learned societies among which the Royal Society, the Chemical Society and the Society of Chemical Industry may be mentioned, which led to the establishment by the former Society of a Board of Scientific Societies.

The British Science Guild, inaugurated several years ago, has done much to impress on the nation the need for scientific organization and educational reform. The Teachers' Guild has also appointed an Education Reform Council, including representatives of science, industry and commerce, while Sir Ray Lankester has formed a Committee on the Neglect of Science, to deal with science in public schools, the older universities and the examinations for the Civil Service. The professors of the Imperial College also addressed to the Lord President, as Chairman of their Governors, a memorial dealing with the need for a national policy and a large output of trained men of science.

These movements have not been confined to professors and to scientific men; the practical man of business, the manufacturer and trader have been as anxious and interested as any.

In the early stages of war, the great steel-makers were in great danger from the possible exhaustion of the supply of chemical glass necessary for the testing of their materials and products. Consulting chemists were in a similar position. The Board of Education had actually to institute a census of all the chemical glass available in the educational institutions of the country in view of the possible need for its requisition.

Fortunately, the Institute of Chemistry set up a Glass Research Committee and Professor Jackson of King's College was enabled to indicate formulæ for a number of special glasses which were rapidly produced by progressive firms. The institute having reached the end of its resources was then assisted by grants made by the Council.

Pottery manufacturers were affected in another way, by the lack of Seger cones used as a guide to the firing of their china and earthenware but Dr. Mellor of the Stoke Pottery School stepped into the breach and supplied the needs of the whole pottery trade. This incident and Dr. Mellor's researches in the making of porcelain for chemical ware, etc., an investigation also undertaken by Messrs. Doulton of Lambeth and the Royal Worcester Porcelain Co.,

suggested to the Stoke potters the possibility of remedying the dangerous position of their industry. Pre-war years had seen the gradual exclusion of earthenware and cheaper kinds of bone china from the world market by the hard porcelain manufactured chiefly in Germany and Austria.

In connection with this industry the Council subsequently recommended a grant for the erection of buildings and equipment and an annual grant for maintenance of about £2,000 per year.

Another industry, which has suffered severely from foreign competition is the silk industry and here again a programme of research has been drawn up and is being attacked and assistance rendered by the Council.

Trade Associations.

There are also movements afoot for the formation of various trade associations and these associations intend to include the prosecution of research among their activities. Representatives of over a hundred firms engaged in chemical industries met during 1916 and resolved "that it is desirable that British firms engaged in the chemical and allied trades should form an association to promote closer co-operation and to place before Government the views of the chemical trade generally; to further industrial research; and to facilitate closer co-operation between chemical manufacturers and various universities and technical schools." An energetic start has already been made by this association. Similar activities prevail in the engineering industries and a Committee appointed to consider engineering education and research has issued a comprehensive and stimulative review of the problems involved. Many of the present trade associations were found to be entirely trading companies or professional associations, but endeavours are being made to enlarge the scope of their activities.

The report states that the movements going on around us make it evident that the difficulties of tradition, trade organization and national temperament which stand in the way of combination and which extend beyond the actual sphere of the Council's operations, must be squarely faced if progress is to be made. The Council instances the commencement of an organization of research in one or two cases, especially the rubber industry, which, however, is connected chiefly with the preparation of the raw material and allied agricultural problems rather than with problems of manufacture.

It is suggested, and this is no doubt true to a certain extent, that a good deal of inertia which British manufacturers have shown towards research may have been due to a realization, partly instinctive and partly based on experience, that research on the small scale which could be afforded by individual firms was a doubtful proposition.

Impediments to Industrial Research.

The small scale on which most British industrial firms have been planned is, in the opinion of the Council one of the principal impediments in the way of organization of research, owing to the long and complicated investigations which are necessary often for the

solution of the fundamental problems lying at the base of these industries. None but the greatest of individual firms or big combinations of firms could venture to attack some of these problems. Here then we have one mode of progress—*viz.*, combination of firms interested in one particular industry. Another impediment apparently is of a financial nature and complaints have been made that the recent substitution of joint stock banks for private banks has hampered enterprise because the modern banking companies are not acquainted with the personnel and policy of many local firms and are, therefore, not prepared to finance new undertakings and developments. The short credit of British banks is also said to be responsible for preventing many firms from competing successfully in foreign markets and in some cases, particularly the Engineers' Association, trusts have been formed to furnish the necessary credit.

In this connection, the Council, while not expressing any opinion on the difficult questions of finance, makes reference to a Committee formed under the Board of Trade "to consider the best means of meeting the needs of British firms after the war as regards financial facilities for trade, particularly with reference to the financing of large overseas contracts and to prepare a scheme for the purpose." This shows that progress is being made in the relationship between finance and research.

Another impediment mentioned is the conversion of businesses into limited liability companies which has thrown the control into the hands of salaried works' managers whose training and experience has been confined to their own industry and who are apt to resist proposals for improvement.

On the other hand there are advantages in the formation of such limited liability companies, especially since such companies can afford a run of unsuccessful trials, if in the end a solution of a particular problem is obtained. Professor Marshal states "When powerful joint stock companies are working in harmony and are not directly or indirectly involved in speculative ventures on the Stock Exchange, or in campaigns for the crushing, or the compulsory fusion of rivals, they generally look forward to a distant future and pursue a far-seeing, if a sluggish policy. They are seldom willing to sacrifice their reputation for the sake of a temporary gain, and they are not inclined to drive such extremely hard bargains with their employees as will make their service unpopular." This last point, says the Council, is of importance since the assistance and good-will of the worker are essential to the promotion of industrial research.

Another point which has been raised is the after-war security for such industries as are prepared to spend money on research and development at the present time. Organization, however, can only be fought by counter organization and the State can only effectively help those who are prepared to help themselves.

Certain industries are, however, essential to the conduct of other important national activities, and these are both scientific in character and relatively small in bulk and with little chance of survival unless safeguarded by the State. These are the so-called key, pivotal or master industries which can never employ a large proportion of the population, because the bulk of their products needed for the world trade is inconsiderable. Yet without them

many other trades would languish or die. Such industries are the magneto industry, the watch-makers' lathe industry, the optical glass industry, the chemical glass and porcelain industries, the fine chemical industry, the dye-stuff, synthetic drug and high explosive industry—the last group being relatively large. Our annual consumption of dye-stuffs before the war was only about two millions sterling, but this has to be considered in respect to the two to three hundred million pounds worth of textiles produced annually in Great Britain. The question of safeguarding key or pivotal industries by State help will depend on several considerations, especially the necessity to the national safety. Thus the watch-makers' lathe industry has a relatively weak claim compared to that of the dye-stuff industry. This argument, however, must not be pushed too far, especially since it is of advantage to include some of the more scientific trades among our industries, and because otherwise the best scientific men will not find openings in manufacture and the status of the industrial man of science will fall.

It is, therefore, the opinion of the Council that the State should encourage and assist those scientific industries which are essential to the national well-being, and assume a greater responsibility for the cost of the necessary research than in other cases.

The Need for a New Outlook.

The Council acknowledges that a great deal of attention must be devoted to convincing the manufacturing world in general that scientific research is a paying proposition and that the shortest means to this end is an attack on the pressing problems which arise in the course of ordinary routine, which ought to be solved by the manufacturer's own scientific staffs, which, however, are often too small for the purpose.

It was in this way that the universities of the Middle States of America convinced the farmers of the value of science to agriculture.

In fact, one of the primary aims of the Council is to encourage and develop a new outlook among manufacturers themselves.

In America the value of research in the progress of German trade has already been recognized and large American firms during the last 20 years have set up research laboratories. In this connection Dr. Mees, Director of the Research Laboratories of the Eastern Kodak Company, has pointed out that three grades of laboratories are needed by every manufacturer who wishes to get the best results from the application of science to his business; (1) the ordinary routine or works laboratory for controlling the quality of raw materials, finished products and processes, (2) an "industrial" laboratory or as it might be described, an "efficiency" laboratory where improvements in products and processes tending to lessen cost of production and to introduce new products on the market, are worked out, (3) the true research laboratory, where fundamental processes and developments are investigated and the underlying theories are studied. Without this type of laboratory, Abbé's work on lenses, and Abbé's and Schott's on glasses or the investigation in Great Britain of the three alkaloids which constitute ergot and the subsequent synthesis of two of them would never have been

accomplished. This kind of research may mean years of unremunerative work and work which for a considerable time may yield no results which can be applied by the manufacturer.

The shortest period in which any considerable results can be expected is five years, while results so considerable as to effect the whole industry cannot be looked for in less than ten years' consecutive work. (I should like at this point, to direct the attention especially of planters in this country to the above statement. The rubber research which has been carried on by the Agricultural Department in this country for the last two years is fundamental work of this nature and it is partly a question of good fortune that such great progress has already been made in so short a time, especially when we take into consideration the absence of any fundamental ideas as to the cause of variability, among those who had been at work on the subject for four or five years previous. B.J.E.).

American and German Practice.

Apart, however, from one or two large and progressive firms, America is still in the experimental stage in this matter and one such experiment which will be watched with interest is the formation of the Mellon Institute, in which an attempt is being made to establish a connection between individual manufacturers and the university so that the advanced student, the university organization and the individual firm can co-operate without hampering the academic freedom of the university professor or endangering the property in any results which may belong to the manufacturer. A similar experiment has also been started at Yale University by which the brass and bronze manufacturers pays the expenses of one or two years of post graduate study and research for selected students, under an agreement by which the student devotes half his time on some problem in which the firms are interested and which may form the basis of a research for his doctor's degree.

The primary difficulty in connection with such schemes is that universities are maintained by endowments and public funds for the common good and it is difficult to reconcile work for individual firms with the public advantage.

The Council states, with regard to the oft-repeated statement *re* the subsidies said to be granted by the German Government to firms for research, that there is only one authenticated case of a grant from public funds to an individual manufacturer. This was a grant of £10,000 to the firm of Schott of Jena to work out with Prof. Abbé on a practical scale the researches initiated by him on optical glasses. At that time, however, Schott was the only optical glass firm in Germany and thus represented a whole industry.

Germany, however, does assist industries by tariffs, preferential railway and canal rates and harbour dues and also spends lavishly on education, especially universities and great technical and commercial high schools and their national research laboratories.

Sphere of the Universities and Technical Colleges.

The question of the part which can be played by the universities and technical colleges is important but difficult. It appears to be conceded that universities are not in a position to investigate the

fundamental theory of a subject upon which the development and maintenance of an industry depends, owing chiefly to the fact that this requires continuity of application by the same investigators over long periods with special apparatus and with the development of special methods.

The problems of modern manufacture are more complex and require longer periods for attack than was formerly the case, as instanced, says the Council, by the 20 years' research necessary to make synthetic indigo a marketable product, hence even if the professors in universities have more freedom from routine on the continent and in America than in England, they are unable to play a dominating part in attacking such problems.

One important part which the professor who keeps in close touch with the needs of the manufacturer, can play, is the training of students in methods of scientific research and in the practical routine uses of a laboratory. The universities can and must be the main sources of research in pure science, the discoveries which lie at the root of all practical and technical applications. It has been shown by Prof. R. A. Gregory that each of the modern applications of science from wireless telegraphy to antitoxims, had its foundations in purely scientific work and was not the result of deliberate intention to make something of service to humanity.

What is especially needed is the endowment of research by the endowment of professorships, so that the universities can offer appointments with greater freedom from financial anxiety.

The universities can also assist smaller firms and less important industries by solving immediate problems and also attack the less complex problems of applied science which are not too extended in their nature.

Work in this direction is already being carried out, *e.g.*, an investigation of the Stilbine dyes at Leeds University, nature and constitution of cellulose fibres at the Manchester School of Technology, degumming of silk at the Imperial College of Science, the design of steam nozzles at Glasgow and Manchester Universities.

Sphere of Special Research Institutes.

For the investigation of the scientific basis of a whole trade, some further machinery is required. This would appear to be the inauguration of special research institutes closely attached to existing universities or technical colleges. The technological departments of some of our present universities have already done much useful and important work, *e.g.*, the metallurgical department at Sheffield, the tinctorial chemistry and leather trades departments at Leeds, the engineering department of the Royal Technical College, Glasgow, the departments of botany and engineering at the Imperial College and the departments of mining and brewing at Birmingham. Something more distinct is, however, required in some cases and two such institutes—*viz.*, a research laboratory and miniature factory attached to the Stoke Pottery School and a research institute for glass at Sheffield University have already been proposed. It is essential to keep the finance separate from that of the university and to give the industry concerned a responsible share in the policy of the

institute. At the same time if affiliation to a university is desirable from the point of view of education in research the university must possess some amount of control.

In the Council's opinion it may be desirable eventually to have such institutes entirely separate from any university, but at the present stage there would be grave danger of depleting our educational institutions if this were done.

Research and Government Departments.

Scarcely less important than the encouragement of research in our educational institutions and factories is a due correlation of the research activities of the Government or of the Government of the Empire. This, states the report, can but be achieved by the free exchange of information given in a spirit of hearty co-operation.

Arrangements will be made by which the Council can keep in close touch with all Government departments concerned with or interested in scientific research and each of the large Government departments have been invited to appoint assessors on the Council. These officers can attend any Council meeting and speak on subjects concerning their own department, but cannot vote.

This method of co-operation has proved to be very valuable from every point of view.

Research and the Empire.

A link has been established between the Council and the Imperial Institute, which under the new regulations is now under the control of the Colonial Office and it is thus hoped to open up a relationship with the Overseas Dominions and Colonies. The needs, however, which led the mother country to formulate a scheme for the organization and development of scientific and industrial research had been realized by other parts of the Empire and the Victorian Government asked that the home scheme might be extended to the Dominions and later the Commonwealth Government decided to work out a plan for the whole of Australia.

A similar movement has begun in Canada and New Zealand also has the matter under consideration.

The organization of research within the Empire must be a slow growth, but it augurs well for the future, that thought should move in parallel lines in places so remote from each other and under such varied conditions.

One of the first and most necessary preliminaries to joint research of this nature will be a systematic survey of the resources of the Empire.

This problem will probably be considered by the Committee formed to deal, among other things, with the question "to what extent and by what means the resources of the Empire should and can be developed?"

Conclusions.

No details of the large and comprehensive plans of the Council which are under consideration, have been given in their first report, nor any reference made to the various researches which the Council

have recommended the Committee of Council to aid; the report has dealt, as will be seen from this abstract, with the principles underlying its actions, and the difficulties which have to be encountered and overcome.

The report summarizes the conclusions of the Council which it considers to be of paramount importance:—Firstly, a largely increased supply of competent researchers; secondly, a hearty spirit of co-operation among all concerned, men of science, men of business, working men, professional and scientific societies, universities and technical colleges, local authorities and Government departments. With regard to the first of these, the Council says, the supply was very limited even before the outbreak of war and the number when war ceases will certainly be insufficient to meet the demand. Industry, like war, requires not only a brilliant group of field officers and a well-organized general staff, but an army of well-trained men. The sphere of the solitary worker or pioneer of science tends to become relatively, if not absolutely, smaller. Without the scientific rank and file it will be impossible to staff the industrial research laboratories which are coming and there is as much need for plodding labour in scientific research as in other kinds of work.

The responsibility for training such men rests with our education department and a larger number of well-educated students must enter the universities.

Co-operation between firms in each industry and between industries and the State is essential, because fundamental research requires a large expenditure on brains and equipment, together with continuous effort.

Nearly thirty years ago Huxley called attention to this aspect of the problem in an address at which he said "Our sole chance of succeeding in a competition which must constantly become more and more severe, is that our people shall not only have the knowledge and the skill which are required, but that they shall have the will and the energy and honesty, without which neither knowledge nor skill can be of any permanent avail. This is what I mean by a stable social condition, because any other condition than this, any social condition in which the development of wealth involves the misery, the physical weakness, and the degradation of the worker is absolutely and infallibly doomed to collapse."

The economic problem lies outside the province of the Council but is recognized by the Council as an important aspect of the great issue and the voluntary efforts of manufacturers in friendly union, which enabled the problem of munitions to be solved, may lead to a new kind of reciprocity between firms, so that both the evils of monopoly and individualism may be avoided. Combination for expenditure on research may come to be considered as a form of insurance. When co-operation has done all that is possible, there will still remain a mass of research work to be carried out by individual firms in their own interests, which will amply repay cost and effort.

If it is supposed, concludes the report, that modern industry can be developed by a process of detailed investigations, a series of particular enquiries, however careful, the time, trouble and expense

involved will be largely wasted. Such a supposition is based on fallacious conceptions of the manner in which scientific research proceeds, and of the way in which the great scientific industries have been built up. It is impossible for the most acute investigator to be sure that a particular line of research will lead to a positive result; on the other hand it will often suggest a diverging enquiry that, if followed up, may produce results even more valuable than the original question. Such loose ends litter the laboratories of firms which confine themselves to the questions of the moment. They lead straight to the basic theory of the subject to the roots that strike down into pure science. They are infinite in number and interminable as the man of pure science knows well; but they often yield results that revolutionize those industries which are empirical in their methods—as what industry is not? and give that control over nature which it is the object of all science, whether pure or applied, to secure.

The discovery of the structure of the indigo molecule led not merely to the synthetic manufacture of this dye, but has enabled the chemist to produce a number of new substances of analogous structure and different shades of colour.

Research of this order does not cease when a problem, even if it be as complicated as synthetic indigo, has been solved. Its ramifications will spread as knowledge grows and will tend to bring industries into intimate relation, which are at present independent of each other, to transform what hitherto have been crafts into scientific industries and to require co-operation not only between different firms in the same industry, but between groups of industries in a continuously widening series of inter-related trades. The forces at work in this respect, will when the nature of these forces is clearly grasped enable them to be organized not only for the benefit of the industries themselves but for the nation as a whole.

Descending from the abstract to the concrete or from generalities to particularities, there is much of importance and interest in the above conclusions which are of direct application to the great rubber industry both from the point of view of the production of the raw product and its subsequent conversion to the manufactured article. Here, to those who have been able to follow the progress of the last few years, is visible the conversion of a craft into a scientific industry and an industry which in time will need the greatest scientific assistance it can obtain. from the fact that even yet we do not know the nature of the rubber molecule which belongs to the group of substances which chemists call colloids, or rather a state in which certain substances exist. Much has already been done in a short time, much more remains to be done.

B.J.E.

FUNGI AND DISEASE IN PLANTS.

AN INTRODUCTION TO THE DISEASES OF FIELD AND PLANTATION CROPS, ESPECIALLY THOSE OF INDIA AND THE EAST.

By E. J. Butler, M.B., F.L.S.,

(*Imperial Mycologist, India.*)

Thacker Spink and Co., Calcutta; 1918, pp. 531 and Index.

IN his preface Dr. Butler makes it clear that this book is written to deal chiefly with Indian field and plantation crops, fruit and forest trees being omitted. Outside India, however, it should be of far greater value than merely "to call attention to the enormous preventable waste of resources by vegetable parasites, especially in the tropics," important as such a demonstration is.

The first part of the book—about one fifth of the whole—is "General" and should appeal strongly to the layman, giving him as it does clear and easily intelligible accounts of the nature, food, life history of fungi, causation of disease by fungi and the principles of the control of plant disease. Few will deny that clear ideas on these subjects should be of as great advantage to Agriculturists as they are of rare occurrence; not through the fault of the planter, but mainly because of the absence of such a book as the one under review. Hitherto attention has been devoted to description of special diseases to the exclusion of what may be called the philosophy of plant pathology.

The second special part deals with diseases of cereals, pulse crops, vegetables, root crops and oil-seeds, dye, drug and spice crops fibres, sugar-cane, tea, coffee and rubber.

Chapter VI to VIII (cereals to root crops) are likely to become of considerable interest when food crops are grown on the hoped-for scale in this country, in fact more than one Indian disease has already appeared.

One fact clearly emerges from the chapter on rubber—that there can be few crops on which the incidence of disease varies more with climate than Hevea, a fact apparently overlooked or unknown to a recent critic of workers in this and other countries (Ashplant—*Tin and Rubber Journal*, 30th January, 1918). When it is found that the serious *Phytophthora* diseases are: in Ceylon, stem (patch) canker, pod-rot and black stripe; in Burma, pod-rot and black stripe; in Southern India, pod-rot and leaf-fall with very little black stripe; in Malaya easily controlled black stripe with no pod-rot or leaf-fall, most people will agree that such variability suggests the need of caution in theorizing as to the efficacy of imported remedial measures.

It remains to be said that the book is well printed, in clear type, on good paper, with points of interest only to mycologists printed in smaller type. There is a copious bibliography, the first of its kind, as far as the reviewer knows, dealing with tropical diseases.

W.N.C.B.

MINUTES OF MEETING OF THE ADVISORY COMMITTEE, DEPARTMENT OF AGRICULTURE,

HELD AT THE OFFICES OF THE DEPARTMENT, ON TUESDAY, 30TH JULY, 1918, AT 11 A.M.

PRESENT:—Mr. L. Lewton-Brain (Director of Agriculture), Chairman, the Hon'ble Mr. R. C. M. Kindersley, Messrs. H. Armstrong, J. S. Ferguson, W. de L. Brooke, Carlyle Bell and L. Mooijaart.

ABSENT:—Messrs. T. W. Hodge, L. A. Irving, J. D. McCulloch, C. Ritchie, W. S. Cookson, R. W. Munro, R. H. Phillips and A. B. Milne.

Dr. Butler, Messrs. B. J. Eaton, F. W. South and G. E. Coombs attended the meeting.

Mr. F. G. Spring (Agriculturist) officiated as Honorary Secretary to the meeting.

1.—MINUTES.

The minutes of the previous meeting held on 23rd April, 1918, having been circulated, were taken as read and confirmed.

2.—QUARTERLY PROGRESS REPORTS.

The quarterly reports of officers of the Department having previously been circulated, were laid on the table and the Chairman invited discussion.

Mr. BROOKE referred to the statement in the Agricultural Chemist's quarterly report that common commercial alum when used as a coagulant has very deleterious effects and suggested that pamphlets, drawing attention to this, be published in Malay, Chinese and Tamil.

Mr. B. J. EATON promised to prepare a pamphlet.

Mr. CARLYLE BELL drew attention to the treatment of brown bast on small holdings as mentioned in the Chief Agricultural Inspector's report. Mr. South pointed out that badly infected trees were useless for tapping and that their removal was desirable not only from this point of view but also provided a limited amount of thinning out.

Mr. FERGUSON asked if it were not possible to enforce thinning out. Mr. South replied that it could only be done under the Agricultural Pests Enactment when a specific disease was present for which thinning out was a remedy. He also explained that even if powers could be obtained it would be necessary to proceed gradually

Mr. FERGUSON asked if replies were being received in satisfactory numbers regarding the brown bast circular. The Chief Agricultural Inspector replied that over 100 replies had already been received.

Mr. Ferguson asked if the leaf disease in the Klang district was spreading seriously and if it would not be necessary to use powerful sprayers for treatment, if it were spreading. The Chief Agricultural Inspector did not think the matter serious at present and mentioned that it would be difficult to obtain such sprayers, at present, as none are available locally.

3.—CO-OPERATIVE OIL MILLS.

The Chairman read a circular letter which he informed the meeting had been drafted by the Hon'ble Mr. A. K. E. Hampshire and Mr. B. J. Eaton on behalf of the special sub-committee of the Advisory Committee and which was to be sent to all Managers and Agents of coconut estates in the Federated Malay States.

Mr. Mooijaart remarked that from this letter it was apparently the opinion of the sub-committee that the smallest area which could be dealt with economically was 14,000 acres and enquired what would be the position provided such area, in any district, was not obtainable. Mr. Eaton replied that their report was based on figures obtained from the running of the Singapore Oil Mills which were hydraulic mills and in the opinion of the sub-committee a smaller hydraulic mill would not be economical in running. Mr. Eaton also added that in his opinion it would probably be possible to work with smaller areas by using the expeller plants such as the Anderson Oil Expeller, and that information was being obtained in regard to both hydraulic and expeller plants.

Mr. Carlyle Bell inquired whether, in view of the statement that it would take about 15 — 16 years to pay off the debentures, the co-operating estates would have to guarantee to send their copra and retain their share in the mills for this period. The Chairman thought that this was a point to be considered by the Management after estates had accepted the principle of co-operation. With regard to support from Asiatic holders, several members thought that if it were realized that the mill or mills were under Government control, such small-holders would be likely to support the mill by sending their copra, but that it was not possible to rely definitely on any guarantee from such owners.

4.—SIPANTAS ESTATE.

Mr. Coombs informed the meeting that the only alteration in the scheme of experiments for Sipantas Estate drawn up by the coconut sub-committee was a reduction in the area under *Nyor gading*—namely, from 100 to 25 acres. Mr. Mooijaart enquired why certain areas totalling, approximately, 400 acres are not to be used for experimental purposes. The Chairman replied that the area in question has somewhat irregular palm growth and, therefore, unsuitable for the experiments planned in the scheme, but at the same time added that the land would be useful in other ways.

It was decided to ask Mr. Phillips for a special report and the Manager for quarterly reports to show clearly the progress being made.

5.—NEW AGRICULTURAL INDUSTRIES.

The Chairman informed the meeting that the sub-committee for experiments had met that morning and asked Mr. Spring to detail the scheme as regards crops and estimates. Mr. Spring reported

that the crops were as follows:—Cocoa, 25 acres; fibres (four varieties), 100 acres; cinnamon, 25 acres; tea, Java, Assam and Chinese, 10 acres of each; limes, 20 acres; bananas, 25 acres; castor oil and other annuals, 50 acres; African oil palm, 100 acres.

The estimated cost was as follows:

Felling, burning and clearing, $75 per acre.
Drains and roads, $10 per acre.
Lining, holing and planting, $25 per acre.
Weeding, $2 per acre per mensem (first year).
Nurseries, $1,800.
Superintendence, $500 per mensem.
Bungalow and store, $5,000.
Cooly lines — 200 coolies at $30 per cooly.
Contingencies, $1,500.
Implements, $1,000 per annum.
Water supply, $1,000.

It was remarked that the programme outlined would probably cover two years' working.

With regard to site, the sub-committee hoped that it would be possible to secure a reserve within reasonable distance of Kuala Lumpur and accessible.

6.—STOCK BREEDING.

The CHAIRMAN reported that the Hon'ble Mr. R. C. M. Kindersley, Mr. Brooke, Mr. Ellis (Assistant Agricultural Inspector, Perak) and himself interviewed the Acting Chief Secretary regarding the stock farm and that they received a sympathetic hearing. The Chairman read a letter addressed to the Under Secretary on the subject of Mr. Ellis going to Hongkong and Manila to study the dairy farm and stock-breeding establishments there.

The Hon'ble Mr. R. C. M. KINDERSLEY urged that Mr. Ellis' visit take place at the earliest possible opportunity. The motion was carried.

7.—CO-OPERATION OF MYCOLOGISTS.

The CHAIRMAN informed the meeting that arrangements had been made for co-operation between the mycologists employed by different bodies to elucidate the question of brown bast.

It was proposed that a meeting of the Standing Committee of the Planters' Association of Malaya, the local Rubber Growers' Asssociation Committee and the Agricultural Advisory Committee might be held to discuss co-operation in connection with rubber research work more especially pests and diseases. Dr. Butler favoured the proposal and hoped the meeting may be held at an early date in order that he may have an opportunity, during his short stay in the Federated Malay States, of being present. The motion was unanimously agreed to.

The meeting was informed that the suggestions of the sub-committee on pests and diseases which had been adopted by the Committee had been submitted to Government.

The meeting terminated at 1 p.m.

MINUTES OF MEETING OF THE PLANTERS' ASSOCIATION OF MALAYA,

held at Sungei Ujong Club, Seremban, on 26th June, 1918, at 10.45 a.m.

PRESENT:

The Honourable Mr. R. C. M. Kindersley (*in the Chair*)

and the following DELEGATES:

From Batang Padang D.P.A.	...	Messrs. H. E. Darby and J. H. Allard
„ Batu Tiga D.P.A.	...	„ T. J. Cumming and G. H. Bennett
„ Central Perak P.A.	...	„ J. S. Ferguson, P. G. Lawford and A. B. Milne
„ Johore P.A.	...	Mr. W. M. Mackay
„ Kajang D.P.A.	...	Messrs. E. G. Leyne, A. C. Hayton and G. L. O'Hara Hickson
„ Kapar „	...	„ L. Mooijaart and W. P. Okeden
„ Klang „	...	„ H. R. Quartley, R. Napier Hendrie and C. Hammond-Smith
„ Kuala Selangor D.P.A.	...	„ T. H. Menzies, H. B. Dudley and G. G. Brown
„ Lower Perak P.A.	...	„ R. H. Dodgson, H. de H. Smith, R. H. Phillips and W. R. C. Gray
„ Malay Pen. Agl. Assn.	...	Mr. J. W. Kennedy
„ Negri Sembilan P.A.	...	Messrs. J. D. McCulloch, C. Ritchie, Jas. Rea, T. S. Hickley, R. Gooch, Geo. Grant, J. Bruce and V. A. Tayler
„ Taiping D.P.A.	...	Mr. A. C. Jameson
„ Ulu Selangor D.P.A.	...	„ N. H. Dakeyne

HONORARY MEMBER.—Mr. L. Lewton-Brain (Director of Agriculture).

VISITORS.—Mr. H. G. R. Leonard (D.C.L., Seremban), Dr. B. Day, Dr. Malcolm Watson, Messrs. R. A. B. Adams, F. T. Wynyard Wright, W. J. Doughty, H. Adair, F. J. Fane, A. R. Thompson, A. Waterfield, H. T. Piper, M. L. Phillips, R. Hodgson, A. G. Robins, P. F. Stewart, R. C. Sherar, T. A. Kennard, C. P. Puckridge, E. F. Hasselhuhn, R. M. Levinge, R. M. S. Keir, J. Norman Sturrock, J. A. Clery, C. B. Purser, C. McH. Keir, A. Campbell, T. E. R. Parsons, N. Skae, H. R. Hanmer, L. G. Standley, H. W. F. King, L. G. Huggins, A. M. Kennedy, W. Watt, G. M. Ure, R. M. A. Maycock, D. Gilchrist, F. A. Denny, W. B. Monilaws, C. H. Swinton, W. L. Leonard, W. Gubbins, Geo. C. Lancaster, A. B. S. Morton, F. Cunningham, T. W. Stewart, H. E. G. Solbe, and J. Firth Fletcher.

SECRETARY.—Mr. H. C. E. Zacharias.

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1. The minutes of the Annual Meeting held on 24th April are, on the motion of Mr. FERGUSON seconded by Mr. Cumming, taken as read and confirmed.

2.—THE LATE Mr. MALCOLM CUMMING.

Mr. Kindersley would take this first opportunity he had of thanking the members for the great honour they had done him in electing him for a second time as their Chairman. He only wished he could give more time to the work involved, but he would assure them that he fully realized the responsibility of the position they had entrusted to him and that he would do everything in his power to be worthy of such trust. (Applause.)

Since their last meeting they had received by cable the news of the death of Mr. Malcolm Cumming—one of the pioneer planters of the Federated Malay States and a Chairman of this Association from 1909 to 1911. Mr. Malcolm Cumming was a fine specimen of a man and his death was a great loss to the planting world. He had put in a great deal of useful work on the Western Front formerly with a Motor Ambulance and latterly in connection with the Church Army Huts. Here in Negri Sembilan where he had spent the last years of his planting life he would be specially missed, but all planters in the East felt they had lost a good friend at home whose sympathy they could always count on and who carried great weight in the City. He would now ask them to pass a vote of sympathy with his widow and family.

The vote is passed in silence, all standing.

Mr. Ritchie would like to add if he might do so at this point that it had been suggested that a memorial should be made to Mr. Malcolm Cumming's work in this country and that it should take the form of a subscription for a Church Army Tent to be called after him. A certain amount of money had already been collected in Negri Sembilan for this purpose and he believed that nearly $1,000 had been obtained so far. However, as there must be many friends of the late Mr. Malcolm Cumming residing outside of Negri Sembilan he would be glad to take this opportunity of making the matter further known. Perhaps even the Planters' Association of Malaya as such would like to take some action in the matter.

Mr. Phillips thinks that the Planters' Association of Malaya certainly should contribute and suggests that each Constituent Association should make a payment based on the total acreage of their members, perhaps ½ a cent per acre. He would therefore formally propose that all Constituent Associations be approached with a view to raising subscriptions on an acreage basis towards a Memorial Fund for the late Mr. Malcolm Cumming in the form of a Church Army Tent or Hut to be named after him.

Mr. Bruce seconds the proposal which is carried unanimously, and the Secretary is instructed accordingly to communicate with all Constituent Associations.

3.—WAR RELIEF.

The SECRETARY submits the following statement *re* payments received by him since 1st April to date:

PLANTERS' WAR RELIEF FUND.

Subscriptions received up to 25th June, 1918.

	$ c.	$ c.
BATANG PADANG, D.P.A.	520.00	
Davidson, R. ...	20.00	
		540.00
BATU TIGA, D.P.A.	140.00	
Balloch, R. B. ...	10.00	
Bell, C.	50.00	
Bennett, G. H. ...	50.00	
Bragg, W. H. ...	40.00	
Chalmers, A. P. ...	30.00	
Crush, C. N. ...	20.00	
Cumming, T. J. ...	50.00	
Davidson, A. ...	20.00	
Davidson, D. C. K....	60.00	
Finkleston, G. ...	10.00	
Gilman, M. A. P. ...	20.00	
McNeill, F.	20.00	
Ord, J. G.	20.00	
Orr, H. Douglas ...	30.00	
O'Malley, F. B. ...	20.00	
Robertson, J. A. ...	20.00	
Sansom, P. N. ...	30.00	
Spooner, A. F. ...	40.00	
Tucker, W. S. Reeve	20.00	
Webb, C. M. ...	10.00	
Will, R. W.	16.00	
Williamson, J. ...	20.00	
		746.00
CENTRAL PAHANG, P.A.		
Birkemose, F. ...	60.00	
McVitie, D. D. ...	45.00	
Sungei Bilut Estate	20.00	
Williams, P. J. A. ...	48.60	
Willis, E. J. ...	30.00	
		203.60
CENTRAL PERAK, P.A.	693.00	
Cauldwell, W. J. ...	20.00	
Jonklaas, W. O. ...	40.00	
Robins, N.	10.00	
Wilson, T. K. ...	30.00	
		793.00
Carried forward ...		2,282.60

	$ c.	$ c.
Brought forward		2,282.60
JOHORE, P.A.		
Anker, E.	30.00	
Batu Anam (Johore) Club ...	166.00	
Becker, F. E. ...	30.00	
Bell, C. E.	20.00	
Bolton, G. V. ...	102.00	
Bradbery, C. ...	100.00	
Bradburne, C. W. ...	100.00	
Cummins, H. ...	30.25	
Creighton, R. G. ...	20.00	
Dawson, G.	10.00	
Gawler, W. N. ...	50.00	
Gilfillan, W.... ...	12.00	
Jessen, G.	57.00	
Le Doux, J. S. ...	25.00	
Monson, J. H. ...	50.00	
Muar River Estate Staff	44.00	
Ramsay, H. H. ...	30.00	
Robertson, A. W. ...	50.00	
Ross, D. A.	40.00	
Smith, St. Alban ...	50.00	
Spencer, E. S. ...	100.00	
Tebrau Estate Staff	93.00	
Tinker, A.	50.00	
		1,259.25
KAJANG, D.P.A.		
Beaty, C.	20.00	
Biggin, B.	10.00	
Clerk, G. P.	40.00	
Cummins, E. N. T. ...	50.00	
Dakeyne, O. P. ...	50.00	
Ferrers, C. R. ...	40.00	
Fowler, H. O. ...	23.50	
Kinder, C.	30.00	
Kindersley, R. C. M.	50.00	
Mactaggart, R. K. ...	14.00	
Miller, C. H. ...	10.00	
Mesney, R. F. ...	30.00	
Moullin, H. R. ...	50.00	
Paul, C.	10.00	
Carried forward ...		3,541.55

	$ c.	$ c.
Brought forward		3,541.85
KAJANG, D.P.A. —(*cont.*)		
Pinhorn, P. R. ...	30.00	
Schwabe, E. M. ...	40.00	
Solbe, H. E. G. ...	100.00	
Sparshott, H. C. ...	20.00	
Tyler, E. W.... ...	40.00	
Wiggins, T. G. ...	10.00	
		667.50
KAPAR, D.P.A.		
Fisher, N.	60.00	
Mooijaart, L. ...	40.00	
O'Brien, W. L. R. ...	50.00	
Pratt, J. C.	9.00	
Stonehewer, E. S. ...	34.00	
Tedlie, T. H. ...	20.00	
		213.00
KELANTAN, P.A.		
Anderson, W. G. ...	50.00	
Archer, L. D. ...	30.00	
Taylor, A. N. ...	20.00	
		100.00
KLANG, D.P.A.	280.00	
Battiscombe, R. B. ...	20.00	
Biddlecombe, H. T. A.	24.00	
Buxton, C. A. ...	40.00	
Gray, F. E. A. ...	20.00	
Greenhill, R. D. ...	50.00	
Gulland, D. L. ...	20.00	
Hendrie, R. Napier...	20.00	
Latimer, T. M. ...	10.00	
Maguire, C.	20.00	
Prior, E. B.	30.00	
Quartley, H. R. ...	150.00	
Roberts, C. L. ...	20.00	
Smith, C. Hammond	50.00	
Trollope, F. A. ...	30.00	
Wakefield, E. C. ...	40.00	
		824.00
KUALA LANGAT, D.P.A.		
Hardingham, H. P. ...	50.00	
Irvine, H. C. d'Arcy...	30.00	
Lendrum, J. B. ...	30.00	
Mann, J. P.	20.00	
Munro, R. W. ...	40.00	
		170.00
Carried forward ..		5,516.35

	$ c.	$ c.
Brought forward		5,516.35
KUALA LUMPUR, D.P.A.	278.84	
Armstrong, H. ...	50.00	
Barnet, G. P. ...	50.00	
Campbell, F. M. ...	50.00	
Coppens, P.	30.00	
Castlefield Estate ...	45.00	
Douglas, J. B. ...	49.95	
Farrell, M.	20.00	
Fraser, W. D. ...	60.00	
Harvey, F. G. ...	40.00	
Harvey, T. R. ...	20.00	
Jeavons, F. C. ...	50.00	
Laddell, R. G. ...	40.00	
Luschwitz, T. H, ...	20.00	
McCrow, D. W. ...	20.00	
Quaife, Dr. W. T. ...	25.00	
Smith, M. Sharpe ...	51.42	
Wilkinson, H. B. ...	40.00	
Zacharias, H. C. E....	30.00	
		970.21
KUALA SELANGOR, D.P.A.		
Brown, T. L. ...	20.00	
Estrange, T. R. L. ...	40.00	
Fesq, E. W.	50.00	
Gordon, W. M. ...	34.00	
Irving, L. A. ...	60.00	
More, Thomas ...	50.00	
Quinton, L. M. ...	20.00	
Stevens, T. L. ...	40.00	
E. D. M. K. K. ...	80.00	
		394.00
LOWER PERAK, P.A.		
Bayley, H.	30.00	
Bayley, R. G. ...	56.00	
Brodie, T.	40.00	
Cruickshank, E. J. ...	10.00	
Dodgson, R. H. ...	20.00	
Dukes, M. B.	20.00	
Hartley, M. R. ...	20.00	
Evans, R. C.... ...	20.00	
McLeod, R. A. ...	20.00	
Park, H. H.	26.00	
Phillips, R. H. ...	40.00	
Ratanui Estate Staff	64.85	
Sabrang „ „	108.00	
Carried forward ...		6,880.56

	$ c.	$ c.
Brought forward		6,880.56
LOWER PERAK, P.A. —(*cont.*)		
Selaba Estate Staff ...	80.00	
Symes, A. B. ...	45.00	
Tobutt, K.	20.00	
		619.85
M. P. A. A.		
Baber, E.	30.00	
Carless, H. G. ...	24.00	
Darke, A. E. G. ...	40.00	
Hargreaves, J. ...	20.00	
Josselyn, E. W. ...	40.00	
Mackay, C. H. ...	36.00	
Mallett, N. W. ...	30.00	
Rasmussen, G. ...	30.00	
Rickeard, H. W. ...	40.00	
Sherwood, B. ...	84.00	
		374.00
NEGRI SEMBILAN, P.A.	420.00	
Adair, H.	30.00	
Adames, T. Slade ...	40.00	
Burgess, I.	34.00	
Clarkson, S. W. ...	20.00	
Crawford, W. P. ...	30.00	
Cuthbertson, T. F. ...	40.00	
Fenton, R. D. ...	40.00	
Foster, M. R. ...	20.00	
Grant, G.	40.00	
Hanmer, H. R. ...	28.00	
Handover, W. P. ...	20.00	
Hay, J. B.	17.00	
Hearn, A. J. ...	20.00	
Heherr, F. J. ...	30.00	
Hickson, C. L. O'Hara	40.00	
Hingston, G. W. ...	100.00	
Carried forward ...		7,874.41

	$ c.	$ c.
Brought forward		7,874,41
NEGRI SEMBILAN, P.A.—(*cont.*)		
King, H. W. F. ...	30.00	
Mansfield, L. ...	28.00	
Maycock, R. M. A. ...	20.00	
Mills, E. G.	200.00	
Mills, G. R.	12.00	
Paterson, A. F. ...	45.00	
Ritchie, C.	30.00	
Reynolds, K. P. ...	40.00	
Sepang Valley Estate	500.00	
Smith, E. E. ...	40.00	
Swinton, C. H. ...	40.00	
Tayler, V. A. ...	100.00	
Watt, W.	20.00	
		2,074.00
TAIPING, P.A.		
Bruas Estate ...	44.00	
Croal, T. Gordon ...	40.00	
Grant, G. A.	40.00	
Moraes, H. F. ...	20.00	
Perera, C.	10.00	
Ritchie, C.	30.00	
Willis, A.	20.00	
		204.00
ULU SELANGOR, D.P.A.	63.25	
Armstrong, F. E. J. ...	20.00	
Brunton, R.	30.00	
Coe, P. F.	20.00	
Dakeyne, N. H. ...	30.00	
Fallon, M. D. ...	40.00	
Fleming, D. J. ...	21.00	
Hastings, P. E. ...	30.00	
Kennaway, M. J. ...	50.00	
Kennedy, W. C. ...	20.50	
		324.75
Grand Total ...		10,477.16

He also reads details of relief granted by the Executive Committee in London and submits the following statement received from Sir William Taylor in respect of the 1st quarter of the current year:

FEDERATED MALAY STATES WAR RELIEF FUND, SCHEME No. 2. STATEMENT OF ACCOUNT, 1st JANUARY TO 31st MARCH, 1918.

Receipts.	Amount. £	s.	d.
Balance from last account	22,743	0	3
Remittances from the Planters' Association of Malaya	1,000	0	0
Contributions from Rubber Companies, received through the Rubber Growers' Association	3,814	5	5
Contributions from Tin Mining Companies having their Head Offices in London	485	0	0
Contributions from individuals	10	10	0
Interest on 6 per cent. Exchequer Bonds	45	0	0
Discount on Treasury Bill (£1,000) matured	23	11	0
	28,121	6	8

Payments.	£	s.	d.	Amount. £	s.	d.
Grants and gratuities :						
Mrs. ——	50	0	0			
„ ——	30	0	0			
„ ——	30	0	0			
„ ——	20	0	0			
„ ——	25	0	0			
——	12	11	10			
Mrs. ——	9	0	0			
„ ——	6	0	0			
„ ——	15	0	0			
——	11	0	0			
Mrs. ——	35	0	0			
——	5	0	0			
——	50	0	0			
Mrs. ——	25	0	0			
				323	11	10
Bank charges				—	4	3
Balance in hand				27,797	10	7
				28,121	6	8

The balance of £27,797 10s. 7*d.* is disposed of as under:

	£	s.	d.
Five per cent. War Loan (£12,000) at cost	11,400	0	0
Six per cent. Exchequer Bonds	2,000	0	0
Five per cent. National War Bonds	13,000	0	0
Deposits in Chartered Bank of India	1,000	0	0
Balance of current in Chartered Bank (£ s. d.) 521 10 3			
Less outstanding cheques 123 19 8			
	397	10	7
	27,797	10	7

(Sd.) W. T. Taylor,
8th April, 1918.

I hereby certify that I have audited the above statement of receipts and payments with the books and vouchers of the Fund and find the same to be correct.

The grants have all been duly authorized by the Committee.

(Sd.) A. H. Cullen.
Chartered Accountant,
Honorary Auditor.

73, Basinghall Street, E.C.,
11th April, 1918.

Mr. KINDERSLEY admits that contributions to this Fund are showing a satisfactory improvement but he hopes that none of them would relax their efforts as on the one hand more men from here were going to the Front and, therefore, fewer men were left here in this country to support the Fund, whilst the calls on the Fund would go on increasing.

4.—PREVENTIVE QUARANTINE.

The SECRETARY reports having sent out Mr. Mooijaart's and Dr. Day's memorandum on this subject as instructed by the Annual Meeting.

Mr. MOOIJAART in formally submitting the report would like to touch on the considerations which had prompted him 18 months ago to put forward this matter. It was evident that this was the time when they ought to put their house in order as regards labour, and presumably all would agree that they should try and get a colonized Tamil labour force. Considering, therefore, the various attractions that this country offered to such labour, he came to look into the question of preventive quarantine which had been raising great doubts in his mind and which he was certain required very careful consideration. It was of course a highly technical subject and he would therefore suggest that this report be submitted to the Port Health Officer in Singapore. Dr. Brooks had for the last 17 years acted in that capacity and had undoubtedly a complete mastery of the subject both as regards the general and the local labour aspects of the matter.

Mr. TAYLER has no doubt that the report was a very valuable one from every point of view. The case had been very clearly put, so much so that he had changed his attitude on the subject primarily because previously he did not really understand what proposal was being put forward. He therefore would have great pleasure in moving the adoption of the report, if it were not for a few points which he thought it would be very expedient either to leave out or to put differently. First of all he found a statement made that preventive quarantine was checking immigration, but he regretted that no evidence had been adduced to support this statement. Again, the conclusions as regards shipping accommodation seemed to him to require altering. From the figures given it was clear that the conditions were not really as bad as the report made it, since both the superficial area and the cubic feet space compared favourably with the minimum required for seamen under the Shipping Ordinance. The writers of the memorandum also seemed to have overlooked the fact of awnings, which to his own knowledge were regularly provided on all boats and as a consequence of which all passengers were by no means driven to the lower deck when there was rain. On page 9, a statement was made that a ship with 2,300 coolies on board had only life-boat accommodation for 150 passengers. It clearly would never do to let such a statement go out with the endorsement of this Association. They all knew that the law provided for a sufficiency of life-boat accommodation and it was a fact that all ships were amply provided with life-belts and buoys and that sufficient rafts were provided for everybody on board. As regards the appendix written by Dr. Macaskill, the method adopted at Port Swettenham of

transferring coolies from the ship to the shore by tongkangs was open to great improvement. At present these tongkangs provided no shelter against the rain and sun and it ought to be an easy matter to provide awnings. Again, the present method of lowering coolies into the tongkangs was very dangerous and he suggests that proper gangways should be provided. The proposals he wished to put forward in connection with this report, therefore, divided themselves into two parts and he now begs formally to move them as follows:

(1) "That while the thanks of the Association be accorded to Mr. Mooijaart and Dr. Day for their very valuable memorandum on preventive quarantine, this meeting does not consider it advisable to adopt it quite in its entirety, para. 3 on page 8 and para. 4 on page 9 appearing to call for amendment."

(2) "That this meeting entirely approves of the proposals contained in paras. 1 to 4 on page 10, particularly as regards

(*a*) the conversion of the present depôt at Negapatam into a Quarantine Camp, and

(*b*) a thorough investigation by Government into the matter of shipping accommodation immediately after the war."

Mr. McCULLOCH seconds both proposals.

Dr. DAY at the invitation of the Chairman agrees that there must be points in the memorandum which are open to argument. Personally, he was no expert either in Port Health or in shipping. At the same time it seemed to him obvious that it was not possible to take the provisions required by the Merchant Shipping Act as a standard for coolies who perhaps for the first time in their life went to sea on such a voyage and were suffering accordingly. Therefore the requirements were obviously different from seamen whose business it was to go down to the sea every day of their life and who had naturally become hardened. It was quite obvious that their coolies required more space than seamen but he thinks that it would be valuable to have the opinion of an expert like Dr. Brooks on such a point. Personally, he could only say that when he once went on board a ship there seemed hardly room for them to stand up. With a big crowd like that on board it was not pleasant to consider the state of affairs when sea-sickness was prevalent. Again the ideas of sanitation on the part of these coolies were of so elementary a nature as not to be comparable to those of the seamen. As regards the point made in regard to life-boats perhaps it had been wrong for them to put that in but he left it to the meeting to judge of what good a raft would be on which say 150 Tamil coolies were crowded say 50 miles from the shore. (Hear, hear.)

Mr. MILNE is afraid that certain Indian papers would be very pleased to get hold of such a statement as this on life-boat accommodation and overcrowding. He therefore fully agrees that it would be diplomatic to edit the report before it was finally adopted by the Association.

Mr. QUARTLEY wishes to know why it was that they got outbreaks of small-pox four days after the arrival of coolies if three days quarantine at Negapatam was considered a sufficiently long time to quarantine coolies.

Dr. WATSON feels that the Association must be very much obliged to Dr. Day and Mr. Mooijaart for their most lucid report. He had once been Port Health Officer at Port Swettenham and could therefore speak with a little knowledge of the things which took place there. He might mention that he had been the originator of the system of getting all coolies vaccinated, who arrived there. One criticism he had heard was that planters seemed rather foolish in asking now for the abolition of preventive quarantine, having first asked for its introduction. Now there had been no preventive quarantine prior to 1911 and the planters never asked for anything in that year except for quarantine against all coolies who came out of the Penang Quarantine Station. (Laughter). He could only say that after that it seemed to become a habit of the Health Department to quarantine all coolies, but when they gained a larger experience it was found that there was no danger at all except in the case of two diseases, cholera and small-pox. As regards small-pox there was only one preventive and that was vaccination and it was a fact that the danger from this disease had been completely eliminated thereby. All coolies on estates were now-a-days vaccinated and the disease was so much under control that they found hardly ever the occurrence of a secondary case. There, therefore, was no need whatever for preventive quarantine as regards small-pox. As regards cholera, the incubation period was two days. Therefore, when coolies had been kept a day in Negapatam and five days at sea and perhaps a day at Port Swettenham there could not be many undetected cases of cholera. It was true that a few odd cases would still occur, but these were due to "carriers"—*i.e.*, men who carried the cholera germs about them for months without detriment to themselves but who were liable to infect others. In these cases obviously no system of quarantine could ever prevent an outbreak of cholera, and it was, therefore, conclusive from a medical point of view that as regards cholera no continuation of preventive quarantine was needed. He thinks, however, that it was most necessary that the disinfection of all clothing should be thoroughly attended to at Negapatam and he remembers an outbreak which was directly due to the neglect of this precaution. Provided then that all clothing was properly disinfected at Negapatam and that the ship arrived with a perfectly clean bill of health with no sickness on board he contends that there was not the slightest reason why such immigrants should be subjected to quarantine. The report moreover was very valuable in the light it shed on the occurrence of pneumonia. Pneumonia was a very serious matter as quite 20 per cent. of all deaths on estates were due to pneumonia. Since 1913 he had noticed many outbreaks of pneumonia on estates and from the facts collected in this report it seemed to him clear that such pneumonia was probably due to the overcrowding and close contact on board ships. The only remedy for pneumonia was plenty of air space. South Africa and Canada had experienced serious outbreaks of pneumonia and had obtained freedom by applying this principle rigorously. He would, therefore, say that the standard for the superficial area and cubic air space required on their ships should not be that required by the Merchant Shipping Act for seamen but should be freedom from pneumonia.

Generally speaking he would impress on them the hygienic rule that more people should not be crowded together than was absolutely necessary because such close contact increased the risk of mumps,

measles, etc. If therefore there was no reason to have preventive quarantine it was a bad thing from a medical point of view to adhere to it and to congregate such large numbers of people. On behalf of the estate medical officers he therefore thinks that he could say that in their opinion it was desirable to do away with preventive quarantine provided of course the other precautions were regularly taken. (Applause.)

Mr. RITCHIE thinks that the points under discussion were of a two-fold nature (1) relating to shipping (2) relating to the abolition of preventive quarantine, and it seemed to him that it would be advisable to get the two points distinct as the shipping question obviously was not one which could be tackled at the present time. He would therefore cordially support Mr. Tayler's resolutions.

Mr. MOOIJAART agrees on his own behalf and that of Dr. Day to amend the memorandum in accordance with Mr. Tayler's suggestions as he personally would like to have the chance of inserting a further paragraph on page 8. He had since learnt from India about the quarantine practice at Negapatam and on page 10 it had been suggested that a Quarantine Camp be established at Negapatam. He would now like to insert the words "on the lines of the Quarantine Camp at Mandapam." Coolies from India to Ceylon had to go through Mandapam where they were kept for three days.

Mr. BENNETT would like to know what advantage planters would get from the abolition of preventive quarantine.

Mr. TAYLER observes that Mr. Bennett's question was answered by chapter 2 of the report, paras. 2, 4, 5 and 6. The Port Swettenham expenses averaged $88,000 a year. If as was shown in this report all the quarantine required was three days in India and no quarantine would be wanted in Port Swettenham except when ships arrived infected, a considerable saving would therefore be effected on this score alone.

Mr. BENNETT does not agree that the saving would be very great as the general expenses would continue whether there were many or few coolies quarantined and that the feeding rate per cooly would necessarily be higher for few coolies than for many.

Mr. KINDERSLEY is glad that Dr. Day and Mr. Mooijaart agreed to amend their memorandum as suggested. The report was certainly a very admirable one and he feels that the Association owed a great debt of gratitude to Mr. Mooijaart and Dr. Day for the tremendous amount of work they had ungrudgingly done.

Mr. FERGUSON thoroughly agrees with Mr. Kindersley's remarks as to the thanks due to the writers of the memorandum but he entirely disagreed with the conclusion that a change should be made in their quarantine arrangements. They knew where they were now but they did not know what would happen if this preventive quarantine were abolished. He wanted to know whether doctors could assure them that 10 days quarantine for cholera was sufficient. His Association had discussed this matter and on their behalf and his own he proposes that the Camp at Port Swettenham be not done away with and that no quarantine be undergone in India.

Mr. PHILLIPS seconds this proposal.

Dr. WATSON wishes to make it quite clear that there is no suggestion that any ship bringing diseased coolies should not be quarantined.

Mr. MOOIJAART begs to propose formally that the report subject to the alterations named be submitted to the Port Health Officer, Singapore, and be then considered again by the Association.

Mr. TAYLER seconds Mr. Mooijaart's proposal and withdraws his own.

Mr. FERGUSON withdraws his motion likewise.

Mr. KINDERSLEY agrees that there was no idea of rushing the matter at all and that the proposal of Mr. Mooijaart therefore was the most satisfactory one.

The proposal is then put to the meeting and carried unanimously.

5.—EXPORT DUTY.

The SECRETARY presents the following correspondence:

"KUALA LUMPUR,
"*8th May, 1918.*

"SIR,

"I have the honour to acknowledge receipt of your letter 14/2228.

"Since then Notification No. 764 was gazetted on the 15th of March, 1918, and my Association were gratified to find that the export duty is no longer based on the London price of rubber.

"At the same time I was instructed to point out that by the Customs Notification published two days ago duty will be assessed for the current week on a price of $112 per pikul, which is greatly in excess of the present price of rubber in Singapore and I am to enquire on what basis these prices are computed.

"I am also instructed to point out that by the cancellation of Notification No. 2383 of 31st July, 1914, the sliding scale contained therein has been done away with, and I am to enquire whether this cancellation is due to an oversight or intentional.

"I have, etc.,
"(Sd.) H. C. E. ZACHARIAS,
"*Secretary.*

"UNDER SECRETARY,
"FEDERATED MALAY STATES,
"KUALA LUMPUR."

"KUALA LUMPUR,
"*28th May, 1918.*

"No. 2928/17.

"SIR,

"With reference to your letter of 8th instant on the subject of the method on which the export duty payable on cultivated rubber is calculated in the Federated Malay States, I am directed to inform you that when under *Government Gazette* Notification No. 764 of 16th

March, 1918, the export duty was from that date fixed at $2\frac{1}{2}$ per cent. of the value calculated at a rate to be notified from time to time in the *Gazette*, the sliding scale for export duty was abolished and the $2\frac{1}{2}$ per cent. rate on the notified value of rubber became applicable to all grades.

"2. The rate is assessed on the basis of the weekly average of the highest Singapore daily market price.

"3. The price $112 per pikul published in Notification No. 1258 of the 3rd May, 1918, as the price fixed for the period 3rd to 9th May was the average highest Singapore price for the week preceeding that for which the price in question was fixed.

"I have, etc.,
"(Sd.) M. S. H. McArthur,
"*Under Secretary to Government, F.M.S.*

"The Secretary,
"Planters' Association of Malaya,
"Kuala Lumpur."

"Kuala Lumpur,
"*30th May, 1918.*

"Sir,

"I have the honour to acknowledge receipt of your letter 2928 of the 28th inst. which has been considered by my Standing Committee, and I am now instructed to enquire for what reason the sliding scale in connection with the export duty on rubber has recently been abolished.

"I have, etc.,
"(Sd.) H. C. E. Zacharias,
"*Secretary.*

"Under Secretary,
"Federated Malay States,
"Kuala Lumpur."

"Kuala Lumpur,
"*12th June, 1918.*

"No. 2928/17.

"Sir,

"With reference to your letter of the 30th May, 1918, on the subject of the export duty on rubber, I am directed to inform you that as the sliding scale of duty gazetted in Notification No. 2383 of the *Government Gazette* of the 31st July, 1914, was based on the price of rubber in London its abolition naturally followed on the adoption of the price of rubber in Singapore as the basis on which the export duty was calculated.

"I have, etc.,
"(Sd.) M. S. H. McArthur,
"*Under Secretary to Government, F.M.S.*

"The Secretary,
"Planters' Association of Malaya,
"Kuala Lumpur."

Mr. KENNEDY observes that at the last meeting of the Federal Council last November it had been distinctly stated that the whole subject of the export duty was to be re-opened. Now a vital alteration had been made but the matter had not been re-opened at all by the Government and they had never been granted an opportunity to give their opinion. They certainly ought to emphasize the fact that the sliding scale was an essential part of the argument of 1914 which introduced an all-in assessment. It was distinctly unfair that without asking them the Government should cancel the original notification just when the sliding scale would come into operation. He would therefore propose that this Association is of opinion that the abolition of the sliding scale as applied to export duty on rubber is an unfair measure and request Government to cancel the Notification of 15th March, 1918, and to re-introduce the Notification of 31st July, 1914, at the same time adhering to Singapore market prices as a basis for assessing the ordinary export duty.

Mr. KINDERSLEY believes that there was no doubt that the Government had made a great mistake in this matter particularly in the manner in which they had acted. For, as regards the abolition of the sliding scale it was clear, if the sliding scale at the present time would do away with all payment of duty, that Government in these abnormal times could not do without some export duty on rubber and that some change could not be obviated.

Mr. KENNEDY does not wish it to be understood that he was referring to the War Tax—this sliding scale as they knew did not at all apply to the special duty. All he meant was that Government ought to have told them clearly that the times were difficult and some change was necessary. As it was they all felt that they had been had.

Mr. GORDON-BROWN seconds Mr. Kennedy's motion.

Mr. RITCHIE questions whether it would not be better to leave the matter more open without going into details. He quite agreed that it required reconsideration but he thinks it would be better to ask for a reconsideration in general in respect of the specific point of re-introducing the sliding scale. He thinks they ought to ask for a further discussion on the subject writing strongly and expressing their dissatisfaction.

Mr. CUMMING thinks the time had gone by for this sort of thing and that it was of no use asking for further consideration. The Government's action was nothing short of sharp practice and it surely would have to be left to the Government to make any suggestion they wanted to.

Mr. RITCHIE explains that he only wished to ask Government to give them an opportunity of discussing further proposals instead of asking them for a definite thing and getting a definite answer on that alone since the whole matter would then finish there. It was entirely a matter of policy.

Mr. TAYLER disagrees and does not think they should content themselves with writing strongly to the Government who had behaved in a most scandalous manner and he had much pleasure in supporting Mr. Kennedy's proposal.

Mr. KENNEDY's motion is then put to the meeting and carried unanimously.

Mr. MCCULLOCH refers to the case of refund of Excess Duty paid in error. The Negri Sembilan Planters' Association had asked for this matter to be put on the agenda of this meeting and on their behalf he would now move that this Association draw the attention of the Government to the anomaly of Government's action in refusing to refund sums of money paid in error and record its great disapproval of the attitude adopted by Government. The incident referred to was the case of Cairo Estate who had paid the War Tax in error. As soon as the Manager discovered it—*i.e.*, the following morning, he had asked for a refund of this money. This the Customs refused and the matter was brought before the Government and at the last meeting he understood that the Government was prepared to reconsider the action but apparently there was still some uncertainty in that the Government had not yet settled the case. The law laid down that claims must be made at the time of shipping but even from a legal point of view this defence was untenable. Reliable legal opinion had been taken to the effect that failure to claim exemption at the time of shipment did not debar from the right of claiming a refund; the deciding factor not being the carelessness or inadvertence of the shipper but that in the legal phrase it was against "conscience and justice" that the receiver should retain money paid in error. It might possibly be necessary for Government to limit the time after which no claim should be admitted, but there could only be one opinion that the present action of the Government was quite untenable and such as no business firm, valuing its reputation for upright dealing would ever adopt. He much regrets to see the idea gaining ground that the Customs Department and the public were there to score against each other if they could. He proposes the following resolution, *viz*: "That this Association draw the attention of the Government to the anomaly of Government's action in refusing to refund sums of money paid in error and wishes to record its grave disapproval of the attitude adopted by the Government."

Mr. TAYLER seconds the proposal, which is carried unanimously.

6.—LABOUR.

(*a*).—INDIAN.

The SECRETARY submits the following letters:

"KUALA LUMPUR,

"*29th April, 1918.*

"SIR,

"I have the honour to inform you that at the Annual Meeting of this Association held on the 24th inst., I was instructed to refer to you the following three matters:

"1. That the Indian Government be asked to allow the return, on or before the termination of the period of their licence, of all kanganies between the ages of 19 and 25 years who have left the Federated Malay States to recruit coolies.

"2. That all kanganies' licences issued between 1st January and 25th February, 1918, over and above the number allotted for January and February, 1918, be considered as extra licences and not taken as part of the licences allotted for the remainder of the year.

"3. That your Committee may consider favourablty at their next meeting the possibility of the further issue of kangani licences after 30th June.

"I have, etc.,
"(Sd.) H. C. E. ZACHARIAS,
"*Secretary.*

"J. R. O. ALDWORTH, ESQ.,
"CHAIRMAN,
"INDIAN IMMIGRATION COMMITTEE,
"KUALA LUMPUR."

"KUALA LUMPUR,
"*11th May, 1918.*

"No. 182/18.

"SIR,

"I have the honour to inform you that your letter dated the 29th April asking:

"(i) That the Indian Government be asked to allow to return, on or before the termination of the period of their licence all kanganies between the ages of 19 and 25 years who have left the Federated Malay States to recruit coolies;

"(ii) That all kangani's' licences issued between 1st January and 25th February, 1918, over and above the number allotted for January and February, 1918, be considered as extra licences and not taken as part of the licences allotted for the remainder of the year;

"(iii) That your Committee may consider favourably at their next meeting the possibility of a further issue of kangani licences after 30th June,

was considered at a meeting of the Indian Immigration Committee which was held on the 5th May current.

"2. Having regard to the fact that the restrictions were imposed by the Government of Madras in the interests of recruiting for the Army, the Committee did not feel justified in asking that all kanganies under 25 years of age be allowed to return to this country. They agreed, however, to forward to the Chief Secretary a resolution that the Government of the Federated Malay States be asked to make representations to the Government of Madras to the effect that registered licence-holders who have left their wives in Malaya be permitted to return to this country.

"3. With regard to the subject numbered (iii) above the Immigration Committee approved a further issue to all estates during July and August of one-sixth of the number of licences allotted to them during the first half year, subject to a minimum of one licence for each estate. The issue of licences after August will be considered after further experience has been obtained. Various

appeals were considered and a further allotment in some cases was allowed; making the total number so far authorized for issue during the first half of the year up to 6,403.

"4. The subject numbered (ii) received the consideration of the Committee, who, while deciding that it was not practicable to accept the proposition, were of opinion that the position would be greatly alleviated by the decision conveyed in my paragraph 3 above.

"I have, etc.,
"(Sd.) J. R. O. ALDWORTH,
"*Chairman, Indian Immigration Committee.*

"THE SECRETARY,
"PLANTERS' ASSOCIATION OF MALAYA,
"KUALA LUMPUR."

"KUALA LUMPUR,
"*14th May, 1918.*

"SIR,

"I have the honour to acknowledge receipt of your letter 182 of the 11th instant and to thank you for the steps taken in respect of the allotment of further licences.

"As regards the return of kanganies under 25 years of age my Committee feel that the point of issue is not that some special hardship has been inflicted on those men who happen to be married, but rather that faith should be kept with all men who left this country on the implied understanding that they would be allowed to return here and who now, rightly or wrongly, may feel that they have been tricked.

"I have, etc.,
"(Sd.) H. C. E. ZACHARIAS,
"*Secretary.*

"J. R. O. ALDWORTH, ESQ.,
"CHAIRMAN,
"INDIAN IMMIGRATION COMMITTEE,
"KUALA LUMPUR."

"KUALA LUMPUR,
"No. 416/18. "*10th May, 1918.*

"SIR,

"In continuation of this office letter of even number dated the 13th April, 1918, on the subject of the emigration of Indian labourers to the Federated Malay States during the year 1918 as authorized by the Government of Madras, I am directed to state that the condition therein mentioned prohibiting the emigration of adult males under 25 years of age has, the Chief Secretary is informed, been imposed by the Madras Government in the interests of recruiting for the Army.

"I have, etc.,
"(Sd.) W. MACKRAY,
"*for Under Secretary to Government, F.M.S.*

"THE SECRETARY,
"PLANTERS' ASSOCIATION OF MALAYA,
"KUALA LUMPUR."

"KUALA LUMPUR,
"*29th April, 1918.*

"SIR,

"I have the honour to enquire what facilities exist for the training at the General Hospital, Kuala Lumpur, of suitable Tamil women as midwives on estates.

"I have, etc.,
"(Sd.) H. C. E. ZACHARIAS,
"*Secretary.*

"UNDER SECRETARY TO GOVERNMENT,
"FEDERATED MALAY STATES,
"KUALA LUMPUR."

"KUALA LUMPUR,
"*16th May, 1918.*

"No. 1755/18.

"SIR,

"With reference to your letter of the 29th April, 1918, enquiring what facilities exist for the training at the General Hospital, Kuala Lumpur, of Tamil women as midwives on estates, I am directed to inform you that the Principal Medical Officer is prepared to arrange for the training at that hospital of not more than six Tamil women at a time as estate midwives.

"2. It is recommended that the training should extend over a period of one year.

"3. As no accommodation for housing such women exists at the General Hospital it would be necessary for them to make arrangements for their own board and lodging in Kuala Lumpur.

"I have, etc.,
"(Sd.) W. MACKRAY,
"*for Under Secretary to Government, F.M.S.*

"THE SECRETARY,
"PLANTERS' ASSOCIATION OF MALAYA,
"KUALA LUMPUR."

"KUALA LUMPUR,
"*29th April, 1918.*

"SIR,

"I have the honour to revert to your letter 4328 of 1st November, 1916.

"At the time we understood that a roster of visitors had been arranged for the Quarantine Camp at Port Swettenham, and I am now instructed to enquire whether these visits to the Camp are still regularly undertaken.

"I have, etc.,
"(Sd.) H. C. E. ZACHARIAS,
"*Secretary.*

"UNDER SECRETARY,
"FEDERATED MALAY STATES,
"KUALA LUMPUR."

Mr. OKEDEN enquires whether new appointments to the Port Swettenham Camp roster were made when people resigned from it.

Mr. KINDERSLEY is unable to give the information.

(*b*).—JAVANESE.

The SECRETARY reads correspondence, and having explained the position, is instructed to reply accordingly.

7.—CROP RESTRICTION.

The SECRETARY reads the following resolution by the Central Perak Planters' Association:

"That this Association is in favour of some matured scheme for the compulsory restriction of output of rubber and Government control of prices. That delegates to the Planters' Association of Malaya be instructed to press for such legislative control by the Imperial Government."

He also tables copy of a scheme recommended by the Local Committee of the Rubber Growers' Association. (Vide Appendix.)

Mr. TAYLER as a member of that Committee explains that this scheme had been drawn up not so much because they were aware of conclusive evidence that there was overproduction but because they felt that it was a scheme which if introduced could be applied whenever a necessity arose. Whatever their opinion on the situation, they were all unanimous that it would be wise for them to be prepared for any emergency.

Mr. GORDON-BROWN can supply Mr. Tayler with the conclusive evidence he requires. He had before him a market report from New York showing stocks there of 75,000 tons of rubber. It seemed obvious that more plantation rubber was being collected than used. Many estates had already restricted their output but many had not. Large numbers of small-holders had also lessened their output as it no longer paid them to collect rubber at $35 per pikul. All voluntary systems, however, were useless and the only fair way to restrict was the rationing of every grower not only in Malaya but in all other countries, and such rationing of course could only be done with Government's assistance. It was obvious that to restrict output meant an increase of the cost per lb. and he would, therefore, like to get a maximum price fixed. It was bad policy to boost up prices ordinarily speaking, but under abnormal conditions like the present it would be a disgrace if for want of energy, to make a bold effort, they allowed this valuable industry worth many millions to be ruined at a time when so many of the owners were fighting and had not time to look after their affairs. They could not allow the weakest to go to the wall and he, therefore, proposes that the Government of Malaya approach the Governments of other plantation rubber producing countries to see if together they could not come to an agreement with the Imperial Government to take over the British grown plantation rubber which would be rationed to supply the Imperial Government's requirements (including those of our Allies). Each country should be apportioned and each country should be left to ration growers accordingly.

It seemed unnecessary to him to work out details of a local scheme of their own until they knew whether this main proposition would be accepted but he thinks that this should be done and done at once without forming any more committees so as to get their Government to get in touch with the other interested Governments. Surely the sooner they got over the preliminaries the better. If later on they found they could not make ends meet and waited till then to ask for help, stocks would have accumulated and the Imperial Government would start with a bad handicap, as buyers would be independent for some time.

As regards Mr. Harvey's scheme it suffered by being only a scheme for this country, whilst surely every country ought to come in. For why should they only ruin themselves if others were not going to come into line? They would have seen in an answer to Col. Ivor Phillips in the House of Commons that the Colonial Government were watching the matter very carefully. He had intended to make a formal proposal such as outlined but on the way to the meeting he had discussed the matter with Mr. Ferguson who he believed would propose another motion, and in order to obtain unanimity he was prepared to waive his own in favour of Mr. Ferguson's proposal.

Mr. FERGUSON says prices had gone down within a few days from $110 to $78 per pikul notwithstanding voluntary crop restrictions and a particularly heavy wintering. He, therefore, quite agreed with Mr. Gordon-Brown that the matter brooked no delay. Need for restriction had become apparent six months ago but it was quite useless to frame any scheme unless other countries would join. He would, therefore, propose that this Association is strongly in favour of the principle involving the restriction of output and the regulation of values by a proper method of legislative control.

Mr. GORDON-BROWN seconds the proposal.

Mr. PHILLIPS, on behalf of the Lower Perak Planters' Association submits the following proposal—*viz.*, "That a comprehensive Committee be forthwith appointed to confer with the Local Committee of the Rubber Growers' Association and the Planters' Association of Malaya Standing Committee to evolve a suitable scheme of legislative control for submission to delegates of the various District Planters' Associations and final approval of the Planters' Association of Malaya with a view to submitting same to the Government."

Mr. KINDERSLEY observes that the last proposal had practically been complied with already and that the scheme put forward by the Rubber Growers' Association Sub-Committee consisting of Messrs. Harvey, Hampshire and Clodd was a very workable one although he agrees with Mr. Gordon-Brown that they should rope in all other Governments including the Dutch Indies. But in approaching the Government it seems to him better to submit to them Mr. Harvey's scheme as a practical guide to show how action could be carried out. As a scheme it seemed to him excellent and he sees no reason why this meeting could not approve of it.

Mr. RITCHIE hardly thinks it possible to express a considered opinion on a scheme the particulars of which had only just been tabled.

Mr. KENNEDY suggests that both schemes be combined and thus placed before the Government. Surely something had to be done when one saw to what extent buyers had the advantage over sellers in Singapore at the present moment. For, if perhaps the production was not greater than the consumption, yet it was unquestionably far in excess of all facilities for shipping. Buyers, therefore, in Singapore could get rubber at knock-out prices and so far producers had been looking on inactively. It seemed to him that to-day they should make a definite pronouncement, not on details but on the principle.

Mr. GOOCH refers to the Australian wool crop having been threatened in the same way by low prices and that the Government had bought the whole clip and thus were regulating prices and maintaining the wool industry in a flourishing state. It seemed to him a lesson of what could be done with rubber.

Mr. FERGUSON insists that they should be able to go to the Government with a clear mandate from this Association that they wanted restriction and then suggestions could be made such as that various other Governments should be approached.

Mr. MILNE believes that they were getting away from the point, as it seemed to him fatuous to imagine that this Association could dictate to the rubber world what should be done. He, therefore, would propose "That this Association hereby requests the Local Government forthwith to approach the Imperial Government to ascertain whether they are prepared to undertake the control of the plantation rubber production and market in accordance with the needs of the allied countries and further that the Governments of other rubber producing countries be informed of such action and asked to co-operate."

Mr. RITCHIE has much pleasure in seconding this proposal.

Mr. FERGUSON withdraws his proposal in favour of the one just moved.

Mr. SMITH says that the Lower Perak Association wanted to know what the attitude of the Local Rubber Growers' Association Committee was. The London Council of the Rubber Growers' Association apparently were convinced that legislation was necessary to produce crop restriction but their Local Committee apparently did not know it yet.

Mr. TAYLER points out that he was speaking with no mandate from the Local Rubber Growers' Association but only personally.

Mr. KINDERSLEY points out that the Rubber Growers' Association Local Committee was a purely advisory body who take their instructions from the London Council of the Rubber Growers' Association. They consequently were not prepared to say whether there was any necessity for legislative action but had drawn up a scheme in case one was required.

Mr. MCCULLOCH observes that it was clearly of no use to go into details of schemes but that they should just ask the Government to consider proposals. As regards the resolution sent in by the Lower Perak Association he had attended the meeting in question and had

told them that for the time being there was no evidence of over-production and he would add that at that time he had not such evidence as for instance was contained in the market report read out by Mr. Gordon-Brown.

Mr. PHILLIPS withdraws his proposal.

Mr. MILNE's resolution is then carried unanimously, and the Secretary is instructed to write to His Excellency the Governor accordingly. He is also instructed to circularize all constituent Associations *re* the Rubber Growers' Association scheme.

Mr. MCCULLOCH refers to an article in the *Straits Times* of 31st May, *re* disturbance of labour caused by crop restrictions, commenting on the extent of unemployment which would be caused thereby and the smallness of the garrison in Singapore. This meeting knew that this view was quite wrong but he thinks it advisable publicly to call attention to it as it was conceivable that it might lead to panic legislation. He would, therefore, here state that if the crop was restricted yet they could use all the labour for other purposes, and even if it was not used on estates there was an infinite scope for such labour in putting roads in order and making new roads and railways like the Ipoh-Gopeng railway which had been postponed again and again on account of shortage of labour. He personally was confident that there would not be any sufficiency of labour for another 10 years.

8.—BALING OF RUBBER.

The following correspondence is tabled:

RUBBER ASSOCIATION OF AMERICA.

"NEW YORK,
"*23rd March, 1918.*

"To Rubber Manufacturers and Importers:

"As the press publications have noted, the War Trade Board has had under consideration the question of a drastic curtailment in the import of various raw materials, amongst them crude rubber—the object of these restrictions being to make available every possible cubic foot of shipping space for use in the Atlantic.

"The Committee on Rubber and Kindred Products has been in close touch with the situation, furnishing interested authorities from time to time statistics and information that they were called upon to give or felt pertinent to the situation.

"In our study of the subject we have found rubber has been satisfactorily transported from the East packed under compression in burlap bales with a cloth liner bound with steel bands or wire, with a resultant saving in steamship space of, approximately, 25 per cent. The rubber arrived in excellent condition.

"The concern that has developed the practicability of this method of packing has very generously placed the full facts at the disposal of the industry.

"In order to deal with the situation intelligently and fairly to all shippers in the Far East, the Rubber Association of America has appointed a Committee of five to be located at Singapore, consisting of the following:

Mr. W. T. Easley;	Mr. R. J. Obott;
Mr. John Donaldson;	Mr. H. S. Godwin.
Mr. J. J. Blandin;	

"The device employed is a steel-press with a packing capacity of about five tons per day. About 100 of them have been ordered by the Association, the larger part of which are now already in transit to Singapore.

"These presses will be disposed of by the Committee to those desiring to purchase them, at approximately their cost and expense to the Association, and every effort will be made to distribute them in the fairest possible manner, not only in the Malay States but Ceylon, the Dutch Indies and adjacent rubber producing countries.

"In the meantime, certain concerns in the East have been able to procure wooden presses locally with a smaller daily capacity.

"The War Trade Board has expressed their hearty interest in this plan and has enquired from us as to our ideas of a date when this form of packing or something similar thereto must be followed in order to obtain an import licence.

"Therefore, it is quite probable that after a certain prescribed time rubber will have to be more closely packed as a condition allowing its entry into this country.

"We are now faced with the possibility of serious curtailment in our imports. The saving in space to be effected by this plan should, in a measure, compensate for any reduction in space that will be allocated to rubber.

"Very truly yours,

"COMMITTEE ON RUBBER AND KINDRED PRODUCTS,

"(Sd.) H. S. VORHIS, "*Secretary.*

"(Sd.) C. T. WILSON, "*Chairman.*"

THE SINGAPORE CHAMBER OF COMMERCE
RUBBER ASSOCIATION.

"CHARTERED BANK CHAMBERS,
"SINGAPORE,
"*3rd May, 1918.*

"DEAR SIR,

"PRESSING AND BALING RUBBER FOR SHIPMENT TO AMERICA.

"We append below, for your information, a copy of an Interim Report by the Sub-Committee appointed to go into this matter.

"Yours faithfully,

"GATTEY AND BATEMAN,
"*Secretaries.*

"*2nd May, 1918.*

"GENTLEMEN,

"The Sub-Committee appointed at the Extraordinary General Meeting of the Association held on the 23rd of March, 1918, to consider the question of pressing and baling rubber for shipment to America has the honour to submit the following Interim Report:

"1. *Sub-Committee.*—The Sub-Committee now consists of Messrs. W. Lowther Kemp (Chairman), J. J. Blandin, John Donaldson, M. A. Cheek, R. J. Obott, H. S. Godwin and P. H. Patterson.

"2. *Presses.*—The following particulars of the presses ordered and forwarded by the Rubber Association of America have been obtained:

"Number of presses forwarded:—100.

"Expected to arrive:—June.

"Price landed here:—About gold $150.

"Type:—Steel hand lever.

"Probable capacity:—Five tons daily. It is stated that the presses will probably not 'exceed' a limit of 225 lbs. sheet or 180 lbs. crêpe per five cubic feet but no guarantee has been received that they will attain this compression.

"The Sub-Committee have been in communication with the various local engineering firms with a view to the manufacture of presses locally and have selected the following three types as being suitable:

(*a*) A rack press, manufactured by United Engineers, Ltd., costing $600 ex Works, Singapore.

(*b*) A 70 ton double toggle jointed press, manufactured by the Central Engine Works, costing $1,115 ex Works, Singapore.

(*c*) A lighter 50 ton double toggle jointed press, manufactured by the Central Engine Works, costing $690 ex Works, Singapore.

"The Sub-Committee have arranged with United Engineers, Ltd., and the Central Engine Works to erect one of each of these types of press for inspection by members of the Association at Messrs. Wilson, Holgate & Co.'s Godown, Robinson Road, by the courtesy of that Company. The presses will be available for inspection from 11 a.m. to 1 p.m. and from 2 p.m. to 4 p.m. from the 6th to the 10th May and from the 13th to the 17th May.

"In view of the fact that these presses have to be manufactured which takes time, the Sub-Committee are of opinion that the placing of orders and the distribution of presses should take place through them and they have accordingly arranged that the Central Engine Works and United Engineers, Ltd., will give priority to all orders for presses placed by the Sub-Committee for a period of one month

from the date the presses are available for inspection. The distribution of the American presses is also in the hands of the Sub-Committee.

"The Sub-Committee propose that orders received from members of the Singapore Chamber of Commerce Rubber Association and rubber estates in the Malay Peninsula shall be treated on an equal basis and the presses as available will be distributed equitably amongst these interests.

"The Sub-Committee regret that they are not in a position to give more definite information as to the presses to come from America and can only assume that as they have been selected by the Rubber Association of America, they will be suitable for the purpose. They have the merit of cheapness. As regards the locally made presses members will be in a position to decide for themselves which type of press they prefer.

"It is suggested that members of the Association shall decide immediately on one or other of the types of presses referred to and place their order with the Sub-Committee..

"*Compression.*—All three types of local presses will compress 240 lbs. of sheet rubber and 180 lbs. of crêpe rubber into five cubic feet. In the opinion of the Sub-Committee, however, these are extreme limits and they do not recommend that a minimum for shipping purposes should be fixed above 225 lbs. sheet and 170 lbs. crêpe.

"*Packing.*—The Rubber Association of America agree that provided the necessary weight of rubber per five cubic feet is compressed into the package, the covering for the package is a matter for the discretion of shippers. Wooden cases will, therefore, be permissible.

"As a number of shippers may, however, prefer to pack in bales the Sub-Committee are making enquiries into the supply of wrapping material and ties.

"*General.*—Communications have taken place between the Rubber Association of America and the Secretary of State for the Colonies with regard to the introduction of regulations to secure economy of tonnage utilized for rubber shipments. Your Sub-Committee have recommended that such regulations should take the form of a definite limit of quantity of sheet rubber and crêpe rubber per five cubic feet. It is contemplated that these regulations shall be brought into effect about the end of July but the exact date is not yet ascertained and your Sub-Committee have asked that they may be consulted before it is brought into force in order to ascertain whether shippers are equipped to comply with the requirements.

"*C. I. F. and Forward Contracts.*—The Sub-Committee are in communication with the Rubber Association of America with regard to the effect of pressing rubber on this business.

"On behalf of the Sub-Committee,

"W. LOWTHER KEMP,

"*Chairman.*

"SINGAPORE CHAMBER OF COMMERCE
RUBBER ASSOCIATION."

9.—FOOD SUPPLY.

The SECRETARY submits the following correspondence:

"KUALA LUMPUR,
"*3rd May, 1918.*

"SIR,

"The present high price of rice was the subject of considerable discussion at the last meeting of this Association held on the 24th ulto.

"As one of the directions in which alleviation might be obtained I was instructed subsequently to ask that your Department accept all quantities of rice for transportation at truck rates instead of pikul rates with a view to assist in the reduction of the price of the commodity.

"I have, etc.,

"(Sd.) H. C. E. ZACHARIAS,
"*Secretary.*

"GENERAL MANAGER,
"FEDERATED MALAY STATES RAILWAYS,
"KUALA LUMPUR."

"KUALA LUMPUR,
"*16th May, 1918.*

"No. G.M.R. 2397/18.

"SIR,

"In reply to your letter of the 3rd instant, I have the honour to inform you that I consider that in the absence of any properly organized system of control of the price at which rice may be sold the only persons who would benefit by the suggested reduction in freight would be the traders. I am not, therefore, prepared to accede to your request.

"I have, etc.,

"(Sd.) G. H. FOX,
"*Ag. General Manager.*

"THE SECRETARY,
"PLANTERS' ASSOCIATION OF MALAYA,
"KUALA LUMPUR."

Mr. OKEDEN asks whether the Railway would grant truck rates to estates for obtaining their supplies direct from the mills, and proposes that the Secretary be instructed to write to the Railway accordingly.

Mr. GORDON-BROWN seconds the proposal, which is carried.

10.—TODDY.

The SECRETARY submits the following correspondence:

"KUALA LUMPUR.
"*29th April, 1918.*

"SIR,

"I have the honour to refer to my letter 3987 of 24th October, 1917, *re* toddy and to enquire whether the policy of encouraging all estates to establish toddy-shops on the lines of the highly successful Gula experiment is receiving the favourable consideration of your Government and whether it is proposed to make the system in question universal, as soon as present licences expire.

"I have, etc.,
"(Sd.) H. C. E. ZACHARIAS,
"*Secretary.*

"UNDER SECRETARY,
"FEDERATED MALAY STATES,
"KUALA LUMPUR."

"KUALA LUMPUR,
"*4th May, 1918.*

"No. 4740/17.

"SIR,

"With reference to your letter of the 29th April, 1918, I am directed to inform you that the Acting Chief Secretary has no doubt that the Residents will give proper consideration to every application made to them for the right to open toddy-shops, but that he is not prepared to issue instructions that preferential treatment must of necessity be given to such applications if received from managers of estates.

"I have, etc.,
"(Sd.) W. MACKRAY,
"*for Under Secretary to Government, F.M.S.*

"THE SECRETARY,
"PLANTERS' ASSOCIATION OF MALAYA,
"KUALA LUMPUR."

Mr. KENNEDY believes that no further proof was really needed for their contention that the system of planters running their own toddy-shops was the only satisfactory solution of the whole question, and illustrates this by figures comparing the results of the estate management of toddy on Gula Estate with the state of affairs previously ruling there under the Tamil management. He submits the following resolution passed at the meeting of the Krian Licensing Board, held at Parit Buntar, on 15th June, 1918, which entirely bore out his contention:

"(i) This Board is of opinion that in view of the extraordinary success and undoubted popularity of the two-fifths or co-operative estate system of licensing and managing estate toddy-shops it is desirable to extend this system in the District.

"(ii) This Board is of opinion that the issue of toddy-shop licences by tender is unsatisfactory and tends to lead to over speculation, to the keeping of false toddy-shop account books and to the adulteration of toddy or the sale of bad toddy.

"(iii) That in the opinion of this Board the system of licensing toddy-shops by tender should be abolished if and when practicable.

"(iv) That in the opinion of this Board it should be practicable to abolish the system of issuing toddy-shop licences by tender when the majority of the estate managers in the District have undertaken the management of the toddy-shops on their estates.

"(v) That in the opinion of this Board in lieu of calling for tenders it should be possible to issue toddy-shop licences in the case of road-side or non-estate toddy-shops to selected applicants at a rental to be fixed on a system analogous to that of the two-fifths or co-operative estate system and that special legislation should then be introduced making the following obligatory:

(*a*) The number of trees to be tapped to be stated on the licence and all such trees to be tapped regularly.

(*b*) All such trees to bear a distinguishing mark and the situation of such trees to be stated on the licence.

(*c*) The number of tappers employed to be stated on the licence and all such tappers to be regularly employed.

(*d*) All tappers to carry an identification pass on their person.

(*e*) All receptacles used for the removal of toddy to bear the same distinguishing marks as the trees tapped.

(*f*) The export of toddy from the District to be illegal except under licence.

(*g*) Every export licence to be subject to the conditions (*a*), (*b*), (*c*), (*d*) and (*e*), above.

(*h*) The price of toddy to be fixed from time to time by the Board in the case of each shop and the same to be posted up in each shop.

"It is pointed out that under present conditions a large staff would be required to adequately supervise the toddy traffic; that in fact there is no special supervisory staff; that the system proposed would require a special supervisory staff but the supervision would be made so easy that a very small and inexpensive staff only would be needed while at the same time the conditions imposed would not be onerous on the licensees.

"Further the introduction of these reforms should lead to a considerable increase of revenue from toddy."

In the face of such evidence he hopes that the Government would re-consider their reply.

Mr. TAYLER asks whether the Deputy Controller of Labour could inform them as to what policy had been adopted for Negri Sembilan.

Mr. LEONARD says that details had been collected in regard to rents and he had now worked out a mathematical formula taking account of all items of expenditure, etc., with the result that it was

now possible to assess a reasonable rent for each toddy-shop in Negri Sembilan based on the turn-over. This formula had been officially adopted for Negri Sembilan and all licences would, in future, be tendered for on this basis. The allegation was always made that Government were giving their licences to the highest bidder. There would now be no further grounds for this as every toddy-shop in Negri Sembilan would have its rent fixed for 1919 and the Government would call for tenders on that basis so that every manager would know exactly what rent he would have to pay if applying for a licence.

Mr. KENNEDY emphasizes that what was required was to abolish the tender system altogether. As long as irresponsible Tamil contractors were allowed to control toddy-shops so long there would be drunkenness and other labour troubles. He, therefore, would move that the recommendations of the Krian Licensing Board be forwarded to the Government and that the Government be asked to reconsider its decision.

Mr. GORDON-BROWN does not think that the two-fifths system was applicable to all estates.

Mr. KINDERSLEY thinks that the Government had met them and believes that not much good would be done by sending in such a resolution after the official reply they had received. He suggests that the object Mr. Kennedy had in view would best be served by publishing the resolution of the Krian Licensing Board in their minutes.

Mr. KENNEDY withdraws his resolution accordingly.

11.—UNITED MALAYA COUNCIL.

The SECRETARY submits minutes of the joint-meeting called by the Planters' Association of Malaya and held on 29th May, when the following two resolutions had been unanimously adopted:

(i) "That the only satisfactory way to deal with the conditions of Government Service in British Malaya is by appointing a local Commission to deal with the whole matter and that such a Commission should be appointed by the Colonial Office to deal with the whole question in the most comprehensive manner and that it should, to a large extent, be composed of unofficial members of the community. This Meeting requests the local Government to urge the Secretary of State for the Colonies forthwith to appoint such a Commission."

(ii) "That this Meeting, representative of the unofficial community of the Malay Peninsula, is of the earnest and well-considered opinion that time has arrived when a Central Council representing unofficial opinion should be established for the purpose of promoting the continued welfare and prosperity of the Peninsula, and that such Council be styled the United Malaya Council."

A constitutive meeting was now called for 31st July and the following had been nominated:

As President:—The Hon'ble Lt.-Col. A. R. Adams.

„ Vice-Presidents:—The Hon'ble Mr. R. C. M. Kindersley,
„ „ Dr. Lim Boon Keng,
„ „ Mr. A. N. Kenion,
W. F. Nutt, Esq., and F. E. Mair, Esq.

Draft rules had been drawn up by a preliminary Sub-Committee and these he now also submitted.

He also reports the receipt of a resolution forwarded by the Kapar District Planters' Association—*viz.*, "that this Association views with great satisfaction the formation of the United Malaya Council as being a means of obtaining an expression of unofficial opinion on matters of general importance to the welfare of the Peninsula."

Mr. Ferguson reports that a similar resolution had been passed by the Central Perak Planters' Association, Mr. Quartley by the Klang District Planters' Association, and Mr. Phillips by the Lower Perak Planters' Association.

Mr. Kindersley considers the formation of the United Malaya Council the most progressive step yet taken in the Malaya Peninsula. He regrets that at the joint-meeting no mention had been made that Mr. W. F. Nutt was the originator of the whole idea which, as most of them would remember, had been put forward by him in the speech made by him in January last at a farewell dinner given to him by the Federated Malay States Chamber of Commerce in Kuala Lumpur. It seemed to him of the utmost importance that the public should be able to express themselves on matters of importance and it should, therefore, be of the greatest advantage to the Government. It was unfortunate that the Singapore Chamber of Commerce was not represented at the joint-meeting in question but since then they had received a letter from the Secretaries pointing out that the Chamber had had no notice that a resolution contemplating the formation of a United Malaya Council was to be moved at this meeting. Their absence on that occasion, therefore, should clearly not be construed as antagonistic on their part to this scheme, and he had every hope that in future the Singapore Chamber of Commerce would take its full share in the new Council. He, therefore, had much pleasure in moving formally the resolution as formulated by the Kapar District Planters' Association and already read out by the Secretary.

Mr. Milne seconds the proposal, which is carried unanimously.

Mr. McCulloch suggests that this meeting should express an opinion as the number of representatives that it wished to delegate if the United Malaya Council was formed. He thinks they should take one per constituent Association as a standard.

Mr. Ritchie would prefer a definite number as otherwise the instruction might be construed to mean that only one delegate from each District Planters' Association would be allowed to attend as Planters' Association of Malaya representative, whilst it seemed

desirable to him that this Association should not bind itself but should have the liberty of appointing any number as circumstances might make it desirable.

Mr. McCULLOCH concurs and suggests that this Association ask to be represented by 20 delegates.

Mr. GORDON-BROWN seconds this motion, which is carried unanimously.

Mr. FERGUSON suggests that it would be advisable for the constitutive meeting to be held on 31st July that the Standing Committee of the Planters' Association of Malaya be delegated to represent the Association. At present they did not know whether the meeting would agree to allow them 20 delegates and there, therefore, seemed no point in electing them now.

Mr. RITCHIE agrees with this suggestion and the meeting accordingly instructs the Standing Committee to represent them at the constitutive meeting of the United Malaya Council.

12.—FEDERAL COUNCIL.

Mr. DARBY draws attention to the letter forwarded by the Batang Padang District Planters' Association which appeared on page 26 of the minutes of the Annual Meeting. He had little to add to this and would now simply move "that this meeting considers that the Planters' representative on the Federal Council should be nominated by the Planters' Association of Malaya and not as at present selected by the Government."

Mr. RITCHIE hardly thinks it opportune to move such a resolution when they were just about to form this new United Malaya Council as it seemed to him obvious that it was the latter body really that should nominate such members.

Mr. DARBY differs as it seemed to him that what they wanted was a representative of the planting industry and not a representative of the general public. However, he had no wish to persist in his motion which he really only put forward to ascertain whether the meeting was generally favourable to the idea contained therein.

Mr. KINDERSLEY believes that that was the case and agrees that pending the formation of the United Malaya Council it seemed perhaps best if this question was allowed to stand over. If necessary it could always be brought up again by the subsequent meeting.

Mr. DARBY agrees and withdraws his resolution accordingly.

13.—RULES.

The SECRETARY submits a proposal by Mr. F. G. Harvey seconded by Mr. A. B. Milne "that the Rules be so altered to provide for the addition of a Vice-Chairman."

Mr. KENNEDY proposes accordingly that "Vice-Chairman" be added in rules 4 and 14.

This is seconded by Mr. FERGUSON and carried unanimously.

Mr. TAYLER observes that if this resolution was confirmed at their next meeting it would be necessary to elect a Vice-Chairman and suggests that nominations should be asked from all constituent Associations accordingly.

The SECRETARY is instructed to circularize all Associations.

14.—MAN POWER.

Mr. KINDERSLEY would like to mention the rumours about conscription and a certain amount of uncertainty which had been created once more as formerly. They had now been officially told that all class "A" men were urgently wanted and as that was so it seemed to him that this country should send more men to the Army even if by doing so they were acting to the detriment of rubber estates. Nobody suggested that there was any lack of rubber for war or any other purposes; in fact rather the reverse was the case. Of course they could not hope to replace all men who went but a good deal could be done by getting neighbouring estates to help. Big estates could look after small adjoining estates and groups of estates should pool staffs. There was no question that estates would not suffer by such an arrangement but were they justified to cling to the highest standard when they knew how many businesses had been broken up at Home by men having to join up? He merely wished to bring up this matter because it seemed quite probable that conscription would be introduced and he wished them all to be fully prepared, and he hoped and believed that all managers and agents would do their very best to allow all men that could go to do so.

Mr. LAWFORD suggests that another way of helping in the war would be to form a permanent camp in Singapore enabling the regiment stationed there to go to India who there again might release some other regiment for service at the Western Front.

15.—GENERAL.

Mr. DAKEYNE observes that his Association had communicated with all Selangor District Planters' Associations on the subject of roads and he gives notice that this subject be placed on the agenda of the next meeting.

Mr. KENNEDY had been asked by his Association to place before this meeting the question of rubber research but owing to the lateness of the hour he preferred to defer this until their next meeting and would ask this matter to be placed on the agenda.

Mr. HICKSON similarly wishes to ask for action to be taken by Government to control the price of quinine which had gone up in a most alarming manner.

The SECRETARY is instructed to place this subject also on the agenda of the next meeting.

With a vote of thanks to the Chair, the meeting terminates at 2.45 p.m.

H. C. E. ZACHARIAS,
Secretary.

APPENDIX.

SCHEME FOR CONTROLLING THE EXPORT OF RUBBER FROM MALAYA IN ORDER TO PREVENT OVERSTOCKS OF RUBBER IN SINGAPORE.

1. The first step is to ask Government to appoint a Committee of five members to be called the "Rubber Export Control Committee" and to appoint a Secretary and clerical staff, who will be paid by Government.

2. This Committee to have full powers to control the export of rubber to Singapore and London.

3. The system of control will be by means of export permits as per schedule attached. Applications for permits in respect of estates of 100 acres and over must be made to the Committee. The permits must have all particulars filled in and be returned to the Committee, accompanied by a certificate of acreage, or by the last Directors' Report, provided such contains proper details of acreage planted. After checking, the permits will be signed on behalf of the Committee and returned to the estates.

4. When an estate makes a despatch of rubber the permit must go with the invoice papers to the port and the Customs Officer, or other Official appointed by Government, must check and enter the shipment on the permit in the space for this purpose, at the same time issuing a pass for the rubber. This pass must follow the rubber until it is shipped from Singapore in order (1) to ensure its being exported as intended, and (2) to secure priority of sale in or export from Singapore in preference to rubber from other than British Possessions.

The permit to be then returned to the estate.

5. The Committee will decide what number of pounds of rubber per acre of land planted to end of 1914 shall be allowed each month, such allowance to be calculated to the best of the ability of the Committee so that no heavy stocks of rubber accumulate unsold in Singapore.

6. The monthly allowance figure so calculated and agreed upon for each month to be published in the *Government Gazette* and all local papers on or before the 20th of each preceding month.

7. When an estate does not take full advantage of its export allowance in any month, the balance may be carried forward to the following month or months. Such unused allowances must be notified to the Committee.

SMALL HOLDERS' RUBBER.

8. The regulation of export of rubber grown by small holders presents more difficulties than in the case of estates.

9. Small holders must apply to their District Land Office for monthly permits to sell in order to dispose of their rubber to licensed rubber dealers. These "permits to sell" are to be issued by the District Officer. The amount of rubber for disposal is to be the multiple of the acres of rubber according to the small holders' "licence to treat" and of the monthly allowance figure.

10. Having procured his "monthly permit to sell" the small holder can dispose of the quantity of rubber specified to a licensed rubber dealer, the latter retaining the "monthly permit" in order to justify his "export permit."

11. The small holders' "licence to treat" is to be endorsed by the District Officer for the amount of rubber for which a permit to sell is issued, the amount being definitely stated.

(*Example*—Say the small holder has five acres of rubber, the monthly allowance is 20 lbs. p.a. for the month of September. The District Officer will issue to him a permit to sell in respect of 100 lbs. rubber, and will endorse his "licence to treat" with—September, 1918—100 lbs. rubber")

12. The licensed rubber dealer will keep all the "permits to sell" handed to him by small holders when parting with their rubber, and when desiring to export rubber will produce to the Export Officer these "permits to sell" to cover his shipment. After checking, these "permits to sell" will be kept back, and a pass for the amount of rubber will be issued in exchange.

(Sd.) F. G. HARVEY,
14th June, 1918.

(I.)

PARTICULARS FOR THE EXPORT OF RUBBER PERMITS.

State

District

Place of export

Name of concern

Registered in

Name of estate

Name of local agents

Name of manager

Acres of rubber planted to end of 1914

Signature, manager of estate

Signature, Control Committee

(II.)

PARTICULARS OF RUBBER EXPORTED.

Monthly Export Allowances.

Month.	No. of acres.	Monthly allowance, lbs. P. A.	Monthly allowance, Total lbs.	Signature of manager.

(III.)

PARTICULARS OF RUBBER EXPORTED.

Actual Monthly Exports.

Month.	Total allowance.	Rubber exported.	Surplus if any.	Signature (export office).

Abstract of Meteorological Readings in the various Districts of Malaya for the month of January, 1918.

District.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru	...	131.0	75.2	80.35	70.60	9.75	72.5	.749	70.6	85.0	...	20.58	6.03
Pahang, Kuala Lipis	...	...	74.8	80.38	70.51	9.87	72.2	...	...	...	...	8.37	2.63
Johore, Johore Bahru	...	...	...	79.87	70.40	...	...	...	...	...	...	26.93	8.13
Singapore, Kandang Kerbau ...	29.822	158.0	76.2	80.9	71.0	9.9	73.0	.752	...	85.0	...	24.98	6.75
Malacca, Durian Daun ...	29.858	132.0	77.0	85.0	69.0	16.0	75.0	.838	...	87.0	N.E.	1.31	.39
Negri Sembilan, Seremban ...	...	133.6	77.2	84.1	69.2	14.9	73.3	.755	70.6	81.5	N.	1.52	.47
„ Kuala Pilah ...	...	137.2	77.1	84.2	66.5	17.7	74.1	.799	72.0	83.9	...	4.85	1.54
„ Port Dickson...	...	107.2	78.8	84.4	72.1	12.3	75.9	.837	73.8	84.8	...	.74	.29
Selangor, Kuala Lumpur ...	29.785	142.7	78.5	84.2	72.2	12.0	73.9	.758	70.9	78.0	Calm	1.66	.53
„ Klang	...	...	77.2	81.7	70.3	11.4	74.0	...	...	...	...	3.11	1.0
„ Kuala Selangor ...	...	...	...	84.9	72.8	12.1	...	...	...	...	...	6.12	1.67
„ Rawang	...	...	...	90.0	...	...	...	...	...	...	...	4.09	1.61
Perak, Telok Anson	...	...	78.7	90.0	69.0	21.0	74.83	.815	...	84.0	...	14.25	2.32
„ Ipoh	...	...	78.4	90.0	68.0	22.0	73.65	.769	75.36	80.0	...	7.75	1.29
„ Taiping	...	110.0	77.4	89.0	67.0	22.0	74.25	.806	...	86.0	...	23.18	4.17
„ The Cottage	...	...	...	...	...	...	...	...	...	...	...	11.14	1.85
„ Parit Buntar	...	...	79.2	91.0	68.0	23.0	75.31	.827	...	84.0	...	8.03	2.55
Penang, Georgetown	29.789	142.6	77.5	85.4	70.2	15.2	74.6	.841	71.87	83.3	N.W.	2.65	1.29
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	...	8.65	3.10
Perlis, Kangar	...	...	...	81.3	68.95	12.42	...	...	...	...	...	.50	.17

Abstract of Meteorological Readings in the various Districts of Malaya for the month of February, 1918.

District.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru	...	144.0	77.5	85.12	67.25	17.87	72.8	.721	69.5	76.0	...	0.38	0.20
Pahang, Kuala Lipis	...	...	77.84	85.07	70.5	14.57	73.09	...	...	...	...	7.61	1.67
Johore, Johore Bahru	...	...	...	85.93	68.71	...	...	...	...	...	...	2.97	.85
Singapore, Kandang Kerbau ...	29.857	159.0	79.9	82.2	71.0	11.2	74.0	.764	...	74.0	...	1.90	.82
Malacca, Durian Daun ...	29.896	142.0	80.0	89.0	69.0	20.0	76.0	.845	...	82.0	N.E.	.50	.50
Negri Sembilan, Seremban ...	...	152.9	78.3	86.2	70.6	15.6	72.5	.683	68.1	73.5	S.W.	1.92	.94
,, Kuala Pilah ...	...	145.6	82.9	90.3	70.3	20.0	77.1	.943	77.1	85.2	...	2.55	2.08
,, Port Dickson ...	...	127.0	80.9	85.9	72.8	13.1	76.7	.845	74.2	80.1	...	3.20	3.20
Selangor, Kuala Lumpur ...	29.783	148.9	81.0	87.5	70.1	17.4	74.3	.725	69.9	70.0	N.W.	2.49	2.49
,, Klang	...	...	78.5	83.8	71.9	11.9	74.4	...	...	...	...	3.79	1.87
,, Kuala Selangor ...	...	...	...	87.2	73.2	14.0	...	...	...	...	...	3.86	2.30
,, Rawang	...	...	...	91.5	...	...	...	...	...	...	...	6.36	4.16
Perak, Telok Anson	...	...	79.39	90.0	69.0	21.0	75.23	.821	...	82.0	...	5.43	2.55
,, Ipoh	...	...	80.51	92.0	68.0	24.0	74.42	.772	71.82	74.0	...	6.33	2.83
,, Taiping	...	112.0	79.66	92.0	68.0	24.0	75.95	.847	...	84.0	...	5.66	1.04
,, The Cottage	...	...	...	...	...	...	...	...	...	...	...	10.35	3.31
,, Parit Buntar	...	...	81.24	91.0	64.0	27.0	76.10	.833	...	78.0	...	.40	.40
Penang, Georgetown	29.819	146.5	81.7	89.6	69.9	...	74.7	.767	69.43	71.4	N.W.	...	...
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	...	.20	.20
Perlis, Kangar	...	...	...	86.43	68.61	17.82	...	...	...	...	...	.21	.16

Abstract of Meteorological Readings in the various Districts of Malaya for the month of March, 1918.

District.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	Temperature.				Hygrometer.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range.	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru	...	148.74	80.6	89.09	69.67	19.35	75.6	.790	72.2	76.	...	0.61	0.37
Pahang, Kuala Lipis	...	...	81.67	89.06	72.45	16.61	75.24	...	...	...	...	3.47	1.84
Johore, Johore Bahru	...	...	89.55	70.97	...	...	...	...	...	...	...	8.76	1.92
Singapore, Kandang Kerbau ...	29.827	164.0	83.0	88.7	72.8	15.9	76.1	.802	...	71.	...	1.32	.61
Malacca, Durian Daun	29.843	155.0	82.0	91.0	71.0	20.0	76.0	.863	...	75.	N.E.	2.42	1.18
Negri Sembilan, Seremban ...	...	154.3	79.8	88.6	72.1	16.5	74.6	.769	71.3	74.1	S.W.	3.09	.90
,, Kuala Pilah ...	...	148.5	81.8	90.1	72.2	17.9	79.2	.944	77.5	86.8	...	11.69	3.42
,, Port Dickson...	...	131.7	82.8	87.1	74.1	13.0	76.1	.834	75.8	72.7	...	2.72	1.33
Selangor, Kuala Lumpur ...	29.777	150.3	82.0	90.6	71.3	19.3	78.5	.742	69.9	69.	N.E.	5.13	1.31
,, Klang	...	...	79.4	85.9	73.7	12.2	75.4	...	...	...	...	3.74	.80
,, Kuala Selangor ...	...	...	...	90.2	74.3	15.9	...	...	...	...	...	.47	.15
,, Rawang	...	...	...	93.1	...	...	...	...	...	...	...	5.10	.94
Perak, Telok Anson	...	...	81.56	92.0	70.0	22.0	76.67	.853	...	80.	...	4.92	1.61
,, Ipoh	...	...	81.51	95.0	69.0	26.0	75.61	.809	73.16	76.	...	13.58	3.85
,, Taiping	...	112.	80.38	93.0	70.0	23.0	76.76	.872	...	85.	...	19.29	3.38
,, The Cottage	...	...	...	...	...	...	...	...	...	...	...	9.34	2.51
,, Parit Buntar	...	...	82.79	93.0	71.0	22.0	77.8	.888	...	81.	...	3.62	1.25
Penang, Georgetown	29.796	149.9	84.1	91.7	72.1	...	76.9	.858	72.1	77.9	N.W.	2.08	1.25
Kedah, Alor Star	...	...	...	...	...	...	...	...	...	...	...	.36	.15
Perlis, Kangar	...	...	...	89.61	71.13	18.48	...	...	...	...	...	2.67	2.60